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February 13, 2009

Mr. John Kessler
Project Manager
Attn: Docket No. 07-AFC-8
California Energy Commission
1516 Ninth Street, MS-15
Sacramento, CA 95814-5512

Subject: Carrizo Energy Solar Farm (07-AFC-8)
CESF Noise Mitigation Plan
URS Project No. 27658060.02800

Dear Mr. Kessler:

On behalf of Ausra CA II, LLC (dba Carrizo Energy, LLC), URS Corporation Americas (URS) hereby submits the CESF Noise Mitigation Plan (Carrizo Energy Solar Farm 07-AFC-8).

I certify under penalty of perjury that the foregoing is true, correct, and complete to the best of my knowledge. I also certify that I am authorized to submit the CESF Noise Mitigation Plan on behalf of Carrizo Energy, LLC.

Sincerely,

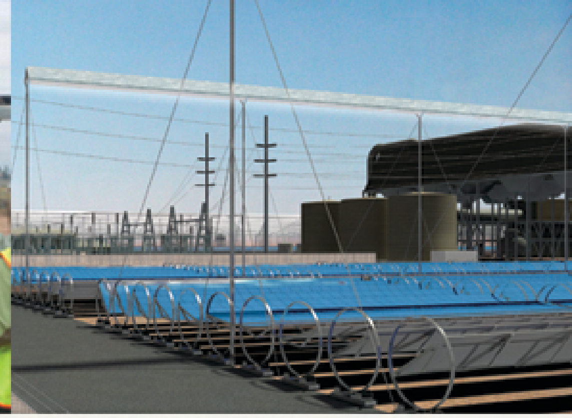
URS CORPORATION

Angela Leiba
Project Manager

AL:ml

Enclosure

URS Corporation
1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108
Tel: 619.294.9400
Fax: 619.293.7920



CESF POST-PSA DRAFT NOISE MITIGATION PLAN

APPLICATION FOR CERTIFICATION (07-AFC-8)
Carrizo Energy Solar Farm
Carrizo Energy, LLC

Submitted to:
California Energy Commission

Submitted by:
Carrizo Energy, LLC

With Support from:

URS

1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108

February 2009

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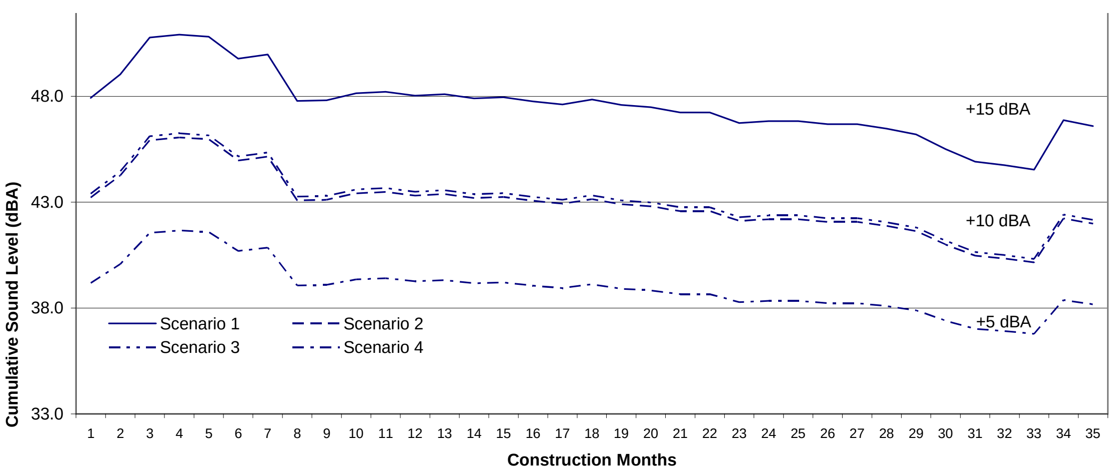
EXECUTIVE SUMMARY

The Preliminary Staff Assessment (PSA) (CEC November 2008) requested Carrizo Energy LLC (the "Applicant") submit a Draft Noise Mitigation Plan (DNMP) to detail specific mitigation options that may be employed during Carrizo Energy Solar Farm (CESF or "Project") construction and operation to reduce identified significant noise impacts. After consideration of several potential noise mitigation options, including those suggested by California Energy Commission (CEC) Staff in the PSA, and as a result of predictive analysis refinement that included worst-case parameters for estimating construction and operation noise, the Applicant has determined that noise levels for all construction and operational phases of the project can be mitigated to less than significant levels as follows:

Construction – In contrast to previous estimation efforts, the Applicant has utilized a more refined predictive modeling technique, Cadna/A®, for estimating Project construction noise. In addition, the Applicant has revised its allocation of construction equipment on a monthly basis, which has included elimination of pile driving. Consequently, Figure ES-1 displays the projected cumulative (*i.e.*, predicted construction noise plus current ambient) noise at the Strobridge noise-sensitive receiver over the 35-month construction period. Note that the loudest anticipated construction month was modeled as a worst-case. No mitigation (Scenario 1) is expected to result in significant impacts per the PSA threshold (>10 dBA increase over ambient). Scenario 2 (construction equipment engine noise suppression upgrades) or Scenario 3 (installation of temporary construction site noise barriers) enables less than significant noise impact for approximately the latter half of the construction duration. Applying both Scenarios 2 and 3 (*i.e.*, Scenario 4) results in less than significant impact for the entire construction period.

Figure ES-1
Predicted Cumulative Sound during Construction of Project at Strobridge



Operation (daytime) – The results of predictive modeling refinements, as shown below in Table ES-1, indicate daytime Project operational noise levels for 100% plant operating capacity are expected to meet PSA criteria for less than significant impact. Specifically, cumulative noise at Strobridge is expected to remain below 40 dBA, the guideline as recommended by the PSA. At other representative noise-sensitive receivers, and while predicted operation noise levels rose or fell with respect to earlier estimates (shown in the NOISE-4 column of Table ES-1) as a consequence of the new modeling, cumulative noise will not rise more than 5 dBA above current ambient daytime levels.

Table ES-1
Predicted Operation Noise for 100% Plant Operation Capacity, Daytime, Emergency Generator Inactive

Receiver	Ambient Daytime Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)	Cumulative (dBA)	Increase over Ambient (dBA)
ML1	48	33	36	48	0
ML3	35	33	34	38	3
ML7	43	17	22	43	0
SR10	50	36	40	50	0
LT01	47	29	33	47	0
Strobridge	33	39	38	39	6
Bell Future	30	28	30	33	3
Bell Existing	30	26	28	32	2
Reyes	37	38	38	41	4

Operation (nighttime) – The results of predictive modeling refinements suggest that the substitution of a conventional combustion-engine powered generator (for powering portable lighting to conduct nighttime Reflector cleaning) with either electric batteries or power drawn directly from the maintenance vehicle (electric or combustion-powered) will enable nighttime Project operational noise levels to meet PSA criteria for less than significant impact: either less than 40 dBA cumulative at Strobridge or less than 5 dBA increase over ambient levels at other receivers. Should the crew maintenance vehicle used for this cleaning activity be electrically powered, prediction results indicate (as shown in Table ES-3 below) that the increase over ambient at Strobridge would also become less than 5 dBA.

Table ES-2
Predicted Nighttime Operation Noise w/ Diesel-powered Crew Vehicle and Battery-powered Portable Lighting Plant

Receiver	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)						Cumulative (dBA)						Increase over Ambient (dBA)					
			Base	A	B	C	D	E	Base	A	B	C	D	E	Base	A	B	C	D	E
ML1	43	27	23	26	24	23	23	23	43	43	43	43	43	43	0	<1	<1	0	0	0
ML3	32	28	23	23	24	25	24	23	33	33	33	33	33	33	<1	<1	<1	<1	<1	<1
ML7	40	12	11	11	10	11	11	12	40	40	40	40	40	40	0	0	0	0	0	0
SR10	50	36	26	35	27	26	26	26	50	50	50	50	50	50	0	<1	0	0	0	0
Strobridge	24	33	26	26	28	28	26	26	28	28	29	30	28	28	4	4	5	6	4	4
Bell Future	25	20	18	20	20	19	19	19	26	26	26	26	26	26	<1	1	1	1	<1	<1
Bell Existing	25	17	16	17	18	17	16	17	26	26	26	26	26	26	<1	<1	<1	<1	<1	<1
Reyes	33	27	27	27	28	29	29	27	34	34	34	34	34	34	1	1	1	1	1	1

Notes:
Base No washing activity
A Crew Vehicle near ML1 and SR10
B Crew Vehicle near Bell
C Crew Vehicle near Strobridge
D Crew Vehicle near ML3 and Reyes
E Crew Vehicle near ML7 and LT01

Table ES-3
Predicted Nighttime Operation Noise w/ Electric Crew Vehicle* and Battery-powered Portable Lighting Plant

Receiver	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)						Cumulative (dBA)						Increase over Ambient (dBA)					
			Base	A	B	C	D	E	Base	A	B	C	D	E	Base	A	B	C	D	E
ML1	43	27	23	23	23	23	23	23	43	43	43	43	43	43	0	0	0	0	0	0
ML3	32	28	23	23	23	23	23	23	33	32	33	33	33	33	<1	<1	<1	<1	<1	<1
ML7	40	12	11	10	10	10	11	11	40	40	40	40	40	40	0	0	0	0	0	0
SR10	50	36	26	30	26	26	26	26	50	50	50	50	50	50	0	0	0	0	0	0
Strobridge	24	33	26	26	26	26	26	26	28	28	28	28	28	28	4	4	4	4	4	4
Bell Future	25	20	18	19	19	19	18	18	26	26	26	26	26	26	<1	<1	<1	<1	<1	<1
Bell Existing	25	17	16	16	16	16	16	16	26	26	26	26	26	26	<1	<1	<1	<1	<1	<1
Reyes	33	27	27	27	27	27	27	27	34	34	34	34	34	34	1	1	1	1	1	1

Notes:

Base No washing activity
A Crew Vehicle near ML1 and SR10
B Crew Vehicle near Bell
C Crew Vehicle near Strobridge
D Crew Vehicle near ML3 and Reyes
E Crew Vehicle near ML7 and LT01

* If feasible

In light of the above findings, the Applicant proposes the following courses of action:

Construction – The Applicant proposes to implement, in a manner that reasonably adheres to the Scenario description so that its predicted mitigation effects may be realized, either Scenario 2 or 3 as part of good construction practice and in combination with construction-related conditions of certification appearing in the PSA (*i.e.*, NOISE-1, -2, -3 and -6), which includes a program to respond to legitimate noise complaints. Should legitimate complaints and/or sound measurements conducted during construction activity determine that additional construction noise mitigation is necessary, the Applicant is prepared to implement the other Scenario not initially elected. This would, in effect, result in Scenario 4.

Operation (daytime) – The Applicant intends to fulfill conditions of certification NOISE-2, -5 and -8 (as appropriate) as written in the PSA. With respect to NOISE-4, the Applicant proposes that the results of its revised predictive analysis, using 100% plant capacity as a worst-case as shown in Table ES-1, becomes the new Project operation noise levels relating to compliance.

Operation (nighttime) – The Applicant intends to fulfill conditions of certification NOISE-2, -5 and -8 (as appropriate) as written in the PSA. With respect to NOISE-4, the Applicant proposes that the results of its revised predictive analysis as shown in Table ES-2, become the new Project nighttime operation noise levels relating to compliance. Unless usage of a conventional combustion-powered generator to power a portable lighting plant can be sufficiently attenuated with conventional noise suppression techniques, the Applicant will employ either battery-powered portable lighting or a method to power such lighting directly from the maintenance vehicle used for nighttime Reflector cleaning activity. Should the goal of a nighttime increase over ambient of 5 dBA or less be applied at Strobridge, and if usage of a suitable electrically powered Reflector cleaning crew vehicle (*i.e.*, instead of a conventional internal-combustion powered one) is considered feasible, the Applicant proposes low voltage (under 48V), low horsepower (under 10HP) commercially available electric-powered vehicles to support this nighttime maintenance task work on the Project site. With electric-powered vehicles, proposed nighttime noise level goals for NOISE-4 would be consistent with Table ES-3.

SECTION 1 INTRODUCTION

The Preliminary Staff Assessment (PSA) (CEC November 2008) detailed a number of concerns regarding the Applicant's noise and vibration assessment as presented in the Carrizo Energy Solar Field (CESF) Application For Certification (AFC) and requested that the Applicant prepare a Draft Noise Mitigation Plan (DNMP) to address these concerns and demonstrate that impacts identified as significant in the PSA can be reduced to less than significant impacts. The purpose of this DNMP is to satisfy the CEC staff request by detailing specific noise mitigation options that may be employed during Project construction and operation to reduce noise and vibration impacts to less than significant levels.

Detailed analyses of construction and operational noise levels were undertaken as part of this effort. Refined modeling techniques were employed to precisely quantify noise emissions and the resulting noise exposure at sensitive noise receptor locations. These results were used to identify targeted mitigation solutions to reduce noise impacts. Section 2 describes general mitigation options that were evaluated and may be employed to reduce construction and operational noise impacts. Section 3 describes the methodology and presents the results of the refined noise modeling and Section 4 presents the recommended mitigation strategies.

SECTION 2 MITIGATION OPTIONS

Potential options for mitigating noise impacts can be categorized by reference to locations along the source-to-receiver transmission path: 1) noise control at the **source** refers to the actual reduction of source noise emissions, 2) attenuation along the sound propagation **path** interrupts or interferes with the sound as it travels from the source to the receiver, and 3) noise mitigation at the **receiver** lessens the impact of sound arriving at the receiver. For maximum benefit, these options may be employed in combination with one another.

While there are a variety of means or methods in each of these categories, not all mitigation options may be available for consideration in all situations. Additionally, certain methods may be incompatible with the Project design or other parameters. For example, noise control at the source is often the most effective method of reducing noise exposure; however, this method may not be possible due to equipment performance specifications. Another example is receiver mitigation, while sound insulation upgrades to a residence may be technically feasible and effective, such upgrades may not be considered desirable by the owner/occupant. The following subsections detail mitigation options that have been pre-screened by the Applicant as being considered potentially reasonable and feasible, and will be evaluated as part of the mitigation strategies in revised predictive analyses for Project construction and operation noise.

2.1 CONSTRUCTION MITIGATION OPTIONS

2.1.1 Temporary Barrier

Temporary sound barriers can be a very effective method of path noise mitigation. To be effective, sound barriers should be constructed of a massive, solid (*i.e.*, no holes, gaps or cracks that might provide bypass for sound) material that has a transmission loss (TL) that is at least 5-10 dBA greater than the expected barrier noise reduction effect. This is necessary to ensure that the sound transmission path through the barrier is acoustically insignificant compared to the sound paths diffracting over and around its ends. A barrier mass per unit area of 20 kg/m^2 is usually sufficient to provide 25 dB of TL at 500Hz. [Beranek & Ver, 1992, p. 130]. Options for providing this kind of barrier material density include the following:

- Solid plywood planks attached to supporting structure—such as a solid fence or wall.
- Flexible blankets or rigid panels of composite-layer construction, usually featuring dense outer layers that sandwich an inner layer of low-density glass fiber batt insulation, supported by a framing system.

As presented in Table 1, a barrier meeting this minimum material parameter could be expected to deliver 5-15 dBA of noise reduction (NR) as long as its top height is sufficiently taller than the construction equipment engine source (*i.e.*, intake, exhaust or casing), and the distance between the source and the barrier does not exceed a specific quantity.

Table 1
Barrier Noise Reduction Variance with ΔH

Source-to-Barrier Distance (D_{SB}, ft)	Barrier Height – Source Height = ΔH (ft)		
	To achieve NR ~ 5 dBA	To achieve NR ~ 10 dBA	To achieve NR ~ 15 dBA
3	0.3	1.7	3.6
7	0.5	2.3	5.0
17	0.7	3.3	7.6
33	1.0	4.6	10.2
66	1.7	6.6	14.5
165	2.3	10.6	23.4

Source: EEI, Vol. 1, 1983, p. 7-12, Table 7.4

Table 1 and the underlying equation provide the base NR estimate for an ideal barrier essentially having infinite length; a real barrier will have ends separated by some finite length. Flanking around these ends of a barrier can reduce NR. For large angles of θ, this NR degradation is substantial, while an angle θ held at 10 degrees as shown by the dimensions of the barrier and corresponding construction work zone in Figure 1, the resulting expected NR might only be reduced by 2-3 dB.

Figure 1
Sample Dimensions for Flat Noise Reduction Barrier

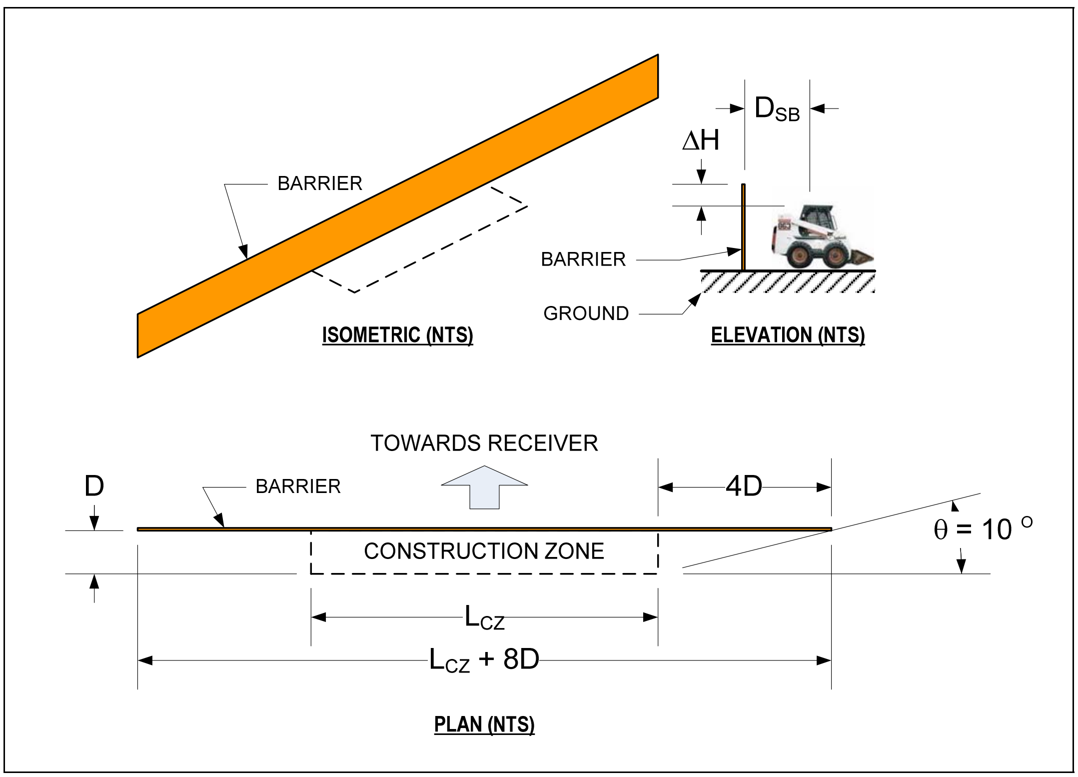
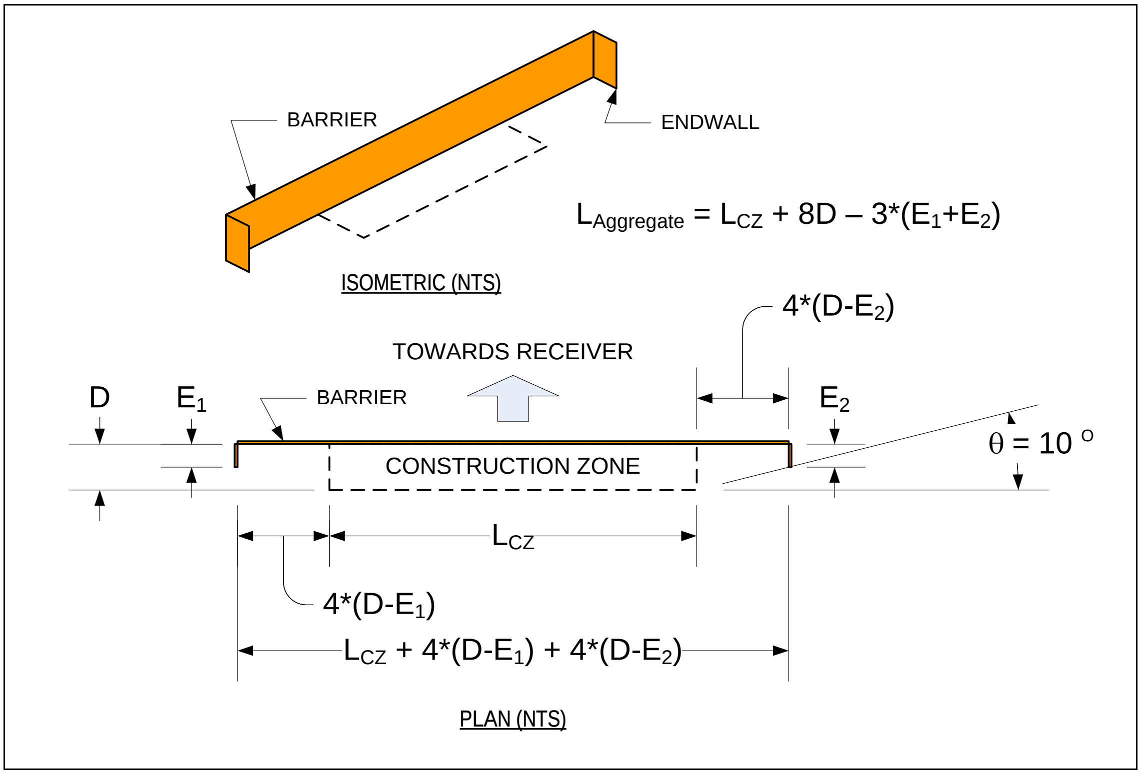


Figure 2 shows an alternative barrier layout requiring a shorter aggregate barrier length by adding sidewalls to the ends of the barrier. These sidewalls help preserve the low-flanking angle θ and maintain the same construction zone footprint. For example, if the intended construction zone had a length of 500' (L_{CZ}) and a depth of 150' (D), the aggregate barrier length from Figure 1 would be 1,700 feet (L_{CZ}+8D). But with endwalls as dimensioned in Figure 2, assuming dimensions E1 and E2 are the same and equal to 75', the aggregate barrier length ($A_{ggregate}$) would only need to be 1,250 feet (*i.e.*, 1,100' plus the two endwalls). This difference in aggregate length can, of course, have considerable impact on the estimated installed cost of this mitigation.

Figure 2
Sample Dimensions for Noise Reduction Barrier with Endwalls



The depth of the construction zone, D, could be made larger so long as ΔH was increased to provide the raw NR per Table 1. If the source height increases, then the barrier height must also increase to preserve ΔH and the raw NR; otherwise, D will have to be smaller. These suggested calculations assume that the receiver is very distant from the barrier with negligible wind and atmospheric effects.

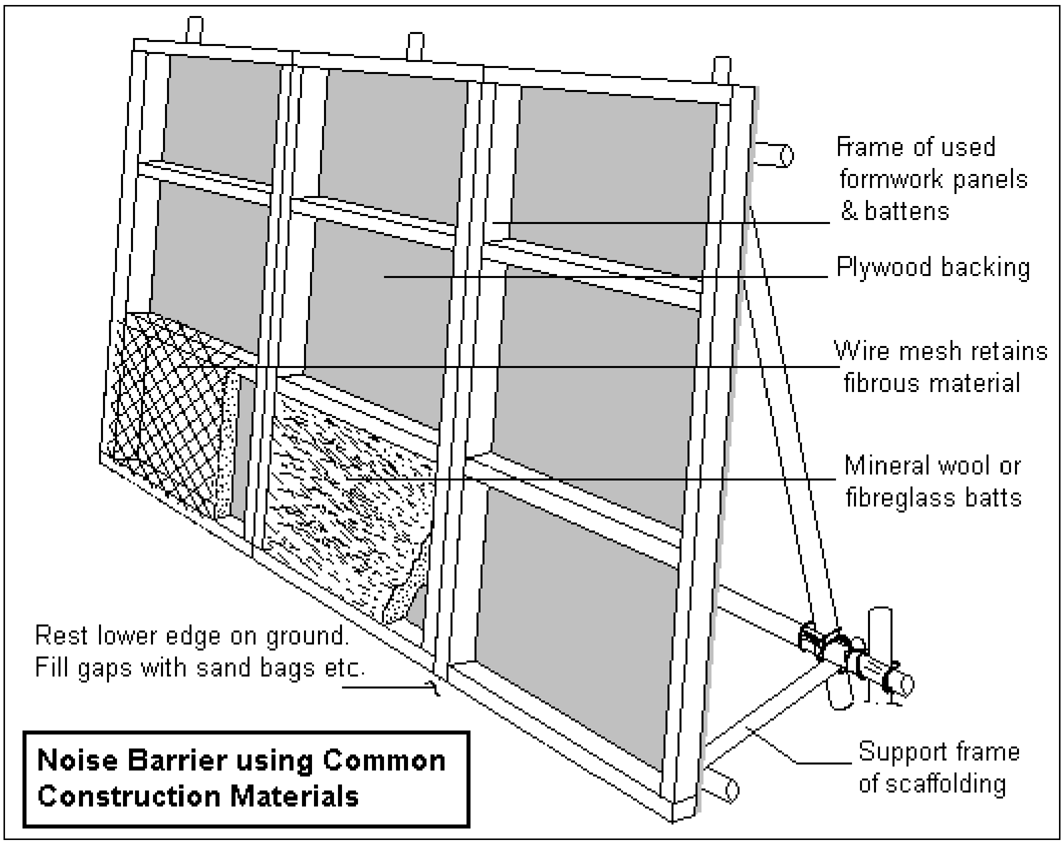
A potential upgrade to either a temporary or permanent barrier is applying acoustically absorptive material to the surface on the side facing the noise source. Samples of this upgrade include the following:

- Application of glass fiber batt insulation, either exposed or covered with weather-resistant yet acoustically transparent fiberglass cloth, on the noise-facing side of a ¾" thick plywood plank wall or fence.

- Perforated metal or plastic skin on the noise-facing side of a sandwich panel, so long as the receiver-facing side is solid and sufficiently massive or dense.

The usage of acoustically absorptive facings helps reduce what might otherwise be reflection of sound off a smooth, solid barrier surface. For instance, if a source is positioned between a barrier and a building or structure, the noise can bounce off a solid barrier surface and use the building surface to reflect towards the receiver, effectively reducing the barrier's intended performance. Absorption on the noise-facing barrier surface can reduce this reflection potential. Figure 3 illustrates a common temporary construction barrier technique using typical construction site materials and resources.

Figure 3
Temporary Noise Barrier Using Common Construction Materials



Source: Eaton, *Construction Noise*, 2000

2.1.2 Equipment Engine Attenuation

Equipment engine attenuation is a source mitigation option that assumes all construction equipment and vehicles powered with an internal combustion engine can be fitted with the following sound attenuating means that will, in combination, enable an overall machine or vehicle noise reduction of at least 5 dBA as considered in this analysis.

- Improved or upgrade exhaust muffler;
- Intake silencer; and,
- Sound absorptive linings, vibration dampeners and additional partial or full enclosures for the engine housing/casing.

These means are typically available as a kit or by special order, and the expected noise reduction of 5 dBA is consistent with both anticipated noise reduction from an industry reference and a sample calculation performed with prediction techniques from Bies & Hansen. In these sample predictions, it can be shown that once the engine exhaust and intake air sound contributors are attenuated with appropriate silencer upgrades, the casing noise can become dominant at certain frequencies and hence limits the feasibility of further noise reduction beyond 5 dBA.

Additionally, one should remember that the model only considers engine noise. It does not include the noise generated by equipment as they impact the earth (*e.g.*, a scraper or grader leveling soils and rocks on the site) or due to equipment contact with the earth—via link-tread or tire—as it travels. It is assumed that such noise is intermittent and of such short duration that it does not meaningfully compare with the engine noise, which is continuous in nature while the equipment is operating.

This mitigation option also does not apply to hand-carried construction equipment, such as pneumatic drills or jackhammers. It is assumed that construction practice on the jobsite adopts practical methods for controlling these potential noise sources, such as the usage of modern slotted circular saw blades that have been demonstrated to reduce noise during cutting operations.

2.1.3 Other Construction Mitigation Options

A number of additional mitigation options were considered but rejected due to being impractical, infeasible, unreasonable, or due to limited effectiveness with respect to the Project or the surroundings as follows:

- **Earthen berms built-up as a consequence of site preparation and stormwater management.** The limited effective height of such berms, even if extending for several hundred feet, would not provide meaningful noise reduction.
- **Moving the Power Block.** Aside from Project layout concerns, moving the Power Block southward approximately 1,250 feet may sound like a large adjustment of distance, but in acoustical terms would net no more than a few (2-3) decibels for noise-sensitive receivers to the north of the Project. In turn, such a move would likely increase estimated noise levels at southern receivers since the Power Block would be 1,250’ closer to them.
- **Erection of temporary barriers at the receivers.** The Applicant does not want to require a receiver to modify their property. Should a receiver be interested in temporary barriers, these options could be evaluated as an alternative to mitigating at the source. The Applicant would not want to mitigate at the receiver if it would materially increase the noise levels at another receiver .
- **Sound insulation upgrades of residential structures.** Such improvements would only be effective for reducing indoor noise levels, not exterior.

- **Construction schedule compression.** The 35-month construction schedule was not compressed, but further evaluation by the Applicant resulted in ways to make alterations (*i.e.*, with respect to the original schedule and construction equipment roster) within the schedule to help reduce the total intensity of equipment activity at a given month.

2.2 PROJECT OPERATION MITIGATION OPTIONS

Project operation mitigation options consist of daytime and nighttime mitigation options. Daytime mitigation options seek to reduce noise impacts associated with power generation. Nighttime mitigation options seek to reduce noise impacts from facility maintenance activities.

2.2.1 Daytime

2.2.1.1 Permanent Sound Barrier

Similar to the temporary barrier described above in Section 2.1.1, a permanent sound barrier was considered as a path mitigation option at the location of the three large water tanks north of the ACC structures and turbine buildings. This barrier would be constructed in a way that "fills" the lateral spacing between the tanks and, depending on barrier height, would have sufficient structural support so that it could extend over the tank tops. This measure was analyzed and rejected as it does not provide required insertion loss (IL), which is defined as the reduction in noise level at a given location due to the placement of a noise control device in the sound path between the sound source and that location.

2.2.1.2 Other Options

A number of additional mitigation options were considered but deemed impractical, infeasible or unreasonable with respect to the Project or the surroundings as follows:

- **Quieter ACC fans.** The ACC manufacturer confirmed that the twenty (20) large-diameter fans composing the array of each ACC represent the quietest fan technology currently available. An ACC with conventional fans would, according to manufacturer data, be 11 dBA higher (*i.e.*, what would sound about twice as loud to the typical human ear) than the one considered in this DNMP. Hence, the Applicant has already planned on making this investment in quiet ACC fan technology for the Project.
- **Moving the Power Block.** Aside from Project layout concerns, moving the Power Block southward approximately 1,250 feet may sound like a large adjustment of distance, but in acoustical terms would net no more than a few (2-3) decibels for noise-sensitive receivers to the north of the Project. In turn, such a move would likely increase estimated noise levels at southern receivers since the Power Block would be 1,250' closer to them.
- **Barrier or "splitter" wall under the ACC.** While the ACC manufacturer confirmed that such a structure would not compromise the ACC aerodynamic performance, it was considered impractical by the Applicant due to seismic and other structural concerns.
- **Barrier(s) at other locations on or around the Power Block.** Due to the elevation of the dominant predicted noise source, the ACC, barriers of constructible heights considered at

different locations on and around the Power Block were found to have very limited noise reduction effectiveness. Or, a few receivers might see benefit while others would experience, effectively, a noise-increasing penalty.

- **Sound insulation upgrades of residential structures.** Such improvements would only be effective for reducing indoor noise levels, not exterior.

The Applicant anticipates daytime Project operational noise levels for 100% plant operating capacity to meet PSA criteria for less than significant impact; however, if daytime operational noise levels were louder than expected, the Applicant would consider mitigation measures including sound insulation upgrades for Strobridge and/or installation of a barrier between the ACC pair and northerly receivers (*e.g.*, Strobridge).

2.2.2 Night-Time

2.2.2.1 Electric Powered Vehicles

For the planned reflector maintenance and cleaning activity expected to be conducted during evening and nighttime hours, the Applicant has considered electric-powered vehicles as substitutes for a typical diesel-burning pick-up truck that would transport maintenance personnel and tow the fuel-burning lighting plant (and its built-in generator). The sample vehicle was assumed to feature an electric motor, typical of specifications found from a handful of current suppliers, and would generate electrical motor noise instead of internal combustion engine noise.

2.2.2.2 Battery-Powered Lighting Plant

Usage of batteries to power a portable lighting plant, in lieu of a portable gasoline or diesel fuel generator, was considered to eliminate the combustion powered generator as a potentially significant nighttime noise source. Possibly more practical, as an alternative, would be to mount lights on the vehicle (*e.g.*, pick-up truck) that draw power from the vehicle’s running engine (or batteries, in the case of electric vehicles). Either way, without the generator noise from previous modeling, the lighting plant was assumed to create only lighting ballast noise that should have amplitude far less than that of a gasoline or diesel-burning generator.

2.2.2.3 Building Parapets

To help reduce noise from anticipated rooftop-mounted building HVAC equipment and systems (*e.g.*, ventilation fans, air-conditioning compressors and air-cooled condenser fans, etc.), short rooftop barriers or “parapets” were considered for the buildings featuring such nighttime HVAC-related noise generators. The intent of these rooftop barriers is to block line of sight (LOS) and provide path mitigation between these continuous noise sources and the surrounding noise-sensitive receivers. Alternately, these short barriers might take the form of partial enclosures that deliver approximately the same magnitude of noise reduction.

2.2.2.4 Other Options

Aside from short barriers briefly considered at locations near the feedwater pumps, which were ultimately decided as impractical due to possible equipment clearance interference, no other mitigation options relating to Project nighttime operation were considered. As will be described in subsequent sections, refinements to the nighttime operation noise model were made in an effort to more accurately or precisely predict noise from anticipated nighttime activity—both continuous (*e.g.,* HVAC) and short-duration (reflector cleaning activity at a location nearest to a noise-sensitive receiver).

SECTION 3 NOISE PREDICTION MODELING

Evaluation of the various mitigation options requires very detailed noise modeling. Highly refined project specific construction and operation noise models were developed to provide the level of detail required for this analysis. Due to this higher level of refinement, noise levels presented in this section may differ from the predicted noise levels presented in the AFC. For purposes of this DNMP, "feasibility" refers to a realistic qualitative and quantitative assessment of mitigation performance. In other words, this term should describe how much noise reduction can be realistically expected from a mitigation option—either on its own or as part of a larger scenario in which multiple options are evaluated in combination.

3.1 CONSTRUCTION NOISE MODELING

3.1.1 Methodology

Noise levels from construction activities are typically calculated using spreadsheet based models, the construction noise model for this DNMP utilizes more precise Cadna/A® software. Cadna/A® was used to create a virtual model of the proposed facility and construction activity. Cadna/A® is a three-dimensional software program for prediction and assessment of noise levels in the vicinity of industrial facilities and other noise sources. Cadna/A® uses source noise emission levels (L_w) and internationally recognized algorithms (ISO 9613-2) for the propagation of sound outdoors to calculate noise levels and presents the resultant noise levels in an easy to understand, graphical or tabular format. The program allows for input of all pertinent features (such as terrain or structures) that affect noise, resulting in a highly accurate estimate of existing and future noise levels.

Digital Terrain Modeling was used to account for elevation and terrain features, and aerial photographs were used to model the existing structures. Noise emission levels were input using octave band levels to accurately estimate noise propagation and attenuation effects. To ensure the validity of the results, the model was tested using previously measured and modeled noise data, and found to be consistent with both practice and theory.

All pieces of equipment that were deemed to be significant noise sources at the proposed facility were included in the baseline noise model. The set of modeled sources included turbine, generators, pumps, motors, and main transformers. Small equipment items, such as pumps less than 25 horsepower, were excluded because they were considered insignificant noise sources. Nominal noise emissions levels from various sources were used for the modeling inputs. The source level data included data provided by vendors, databases of previously modeled similar projects, and industry-standard estimated sound power values. Major buildings, tanks, and large equipment trains were included as barriers where appropriate. The Cadna/A® model output predicted noise levels at several discrete locations and areas of equal noisiness around the proposed project site.

Attenuation due to spherical wave divergence, topographic features, barriers, and standard atmospheric absorption (70 percent relative humidity, 10°C) was included in the calculation of predicted noise levels. Attenuation due to wind or temperature gradients was not subtracted from the predicted levels to provide a conservative estimate of project sound levels. This departure from the spreadsheet-based method used to predict aggregate construction noise for the AFC is considered to be more accurate for the following reasons:

- Sound sources are input as sound power levels at octave band resolution, not merely single-value overall A-weighted levels. This source definition refinement allows better targeting of noise mitigation need (and consequently, noise control or sound abatement means) at the octave bands that most influence the A-weighted overall levels.
- Per the industry-accepted ISO 9613-2 standard, Cadna/A® includes air absorption and ground effects in its algorithms. These are two potential sources of natural attenuation that were not included, for the purpose of conservatism, in the spreadsheet-based model but can be accurately assessed with ease by Cadna/A®.
- Whereas the spreadsheet model considered the uncertain positions of multiple sound sources lumped together at one or more "acoustic centers" (*e.g.,* Power Block, Onsite Manufacturing Facility), Cadna/A® can more realistically allow individual sources to occupy or move about pre-defined areas which will be referred to as "construction zones".

To better understand the specifics of how construction noise is analyzed in Cadna/A® for this DNMP, the following subsection describes the Baseline model and its underlying parameters and assumptions. Subsequently, a number of Scenarios are described that represent major and minor changes to the Baseline model for purposes of evaluating the combined effect of one or more previously described mitigation options.

3.1.2 Baseline Construction Modeling

3.1.2.1 Model Space

The Project area and its vicinity, up to approximately 2 miles distant from the Project boundary, were defined by the following available information:

- Topographical data at 15' increment resolution
- Receiver locations as defined by County records (*e.g.,* issued permits, APN parcel numbers) and supported by survey observations that include GPS data and aerial photography.

3.1.2.2 Construction Noise Sources

3.1.2.2.1 Sound Power Levels

Proposed construction equipment were evaluated and sound power levels (PWL) of individual construction equipment were refined by comparison with data from the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM), which was developed largely as part of construction noise study and mitigation planning for the recently completed Central Artery project (a.k.a., "the Big Dig") in Boston, Massachusetts. The equipment contained in the RCNM is representative of the equipment to be used for Project construction.

Table 2
Construction Equipment Predicted Source Sound Power Levels

Equipment Description	Utilization	HP	Base Sound (SPL at 1m, dBA)	Sound Power Level	31.5	63	125	250	500	1000	2000	4000	8000	dBA	Source
Pick-up truck (1/2 ton)	40%	150	79	87	87	76	81	84	79	77	74	68	62	82	I
Flatbed - Stake Body Truck (1 ton)	40%	220	108	116	116	105	110	113	108	106	103	97	91	111	I
Truck (2.5 ton)	40%	275	112	120	120	109	114	117	112	110	107	101	95	115	V
Dump Truck (15 cy)	40%	275	108	116	116	105	110	113	108	106	103	97	91	111	I
Compactor (Bomag BW211)	20%	130	104	112	112	101	106	109	104	102	99	93	87	107	I
Excavator (8 ton Case 580)	40%	90	109	117	117	106	111	114	109	107	104	98	92	112	I
Excavator (25 ton Cat 225)	40%	135	109	117	117	106	111	114	109	107	104	98	92	112	I
Dozer (Cat D6)	40%	140	110	118	118	107	112	115	110	108	105	99	93	113	II
Dozer (Cat D8)	40%	300	119	127	127	116	121	124	119	117	114	108	102	122	II
Scraper (11 cy or 22 cy)	40%	330	109	117	117	106	111	114	109	107	104	98	92	112	I
Grader (Cat-12)	40%	125	109	117	117	106	111	114	109	107	104	98	92	112	III
Backhoe (Cat 225)	40%	135	104	112	112	101	106	109	104	102	99	93	87	107	I
Case Backhoe/Front End Loader (580)	40%	90	104	112	112	101	106	109	104	102	99	93	87	107	I
Plate Compactor	50%	5	104	112	112	101	106	109	104	102	99	93	87	107	I
Water Truck	40%	220	108	116	116	105	110	113	108	106	103	97	91	111	VI
Fuel Truck	40%	220	108	116	116	105	110	113	108	106	103	97	91	111	VI
Bus (50 seat)	5%	275	93	101	101	90	95	98	93	91	88	82	76	96	VII
Bus (20 seat)	5%	225	93	101	101	90	95	98	93	91	88	82	76	96	VII
ATV	20%	10	98	106	106	95	100	103	98	96	93	87	81	101	VIII
Hydraulic Mobile Crane (15 ton)	16%	130	109	117	117	106	111	114	109	107	104	98	92	112	I
Hydraulic Mobile Crane (35 ton)	16%	175	109	117	117	106	111	114	109	107	104	98	92	112	I
Hydraulic Mobile Crane (50 ton)	16%	250	109	117	117	106	111	114	109	107	104	98	92	112	I
Hydraulic Mobile Crane (80 ton)	16%	300	109	117	117	106	111	114	109	107	104	98	92	112	I
Crane (100 ton)	16%	290	109	117	117	106	111	114	109	107	104	98	92	112	I
Crane (200 ton)	16%	340	109	117	117	106	111	114	109	107	104	98	92	112	I
Manlift (60')	20%	65	109	117	117	106	111	114	109	107	104	98	92	112	I
Manlift (scissors)	20%	20	109	117	117	106	111	114	109	107	104	98	92	112	I
Forklift (6 ton)	20%	75	80	88	88	77	82	85	80	78	75	69	63	83	IX
Forklift (10 ton)	20%	100	80	88	88	77	82	85	80	78	75	69	63	83	IX
Concrete Pump Truck	20%	250	106	114	114	103	108	111	106	104	101	95	89	109	I
Telescopic Handler 4 ton	20%	75	106	114	114	103	108	111	106	104	101	95	89	109	X
EWP 80' boom	20%	75	109	117	117	106	111	114	109	107	104	98	92	112	XI
EWP 135' boom	20%	150	109	117	117	106	111	114	109	107	104	98	92	112	XI
Air compressor - Electric (165 CFM)	40%	40	101	109	109	98	103	106	101	99	96	90	84	104	IV
Air compressor - Electric (250 CFM)	40%	60	97	105	105	94	99	102	97	95	92	86	80	100	IV
Portable Welding Machine	40%	50	97	105	105	94	99	102	97	95	92	86	80	100	I
Electric Welding Machine (6 pack)	40%	n/a	97	105	105	94	99	102	97	95	92	86	80	100	I
Engine Generator Set (30kVA)	50%	40	94	102	102	91	96	99	94	92	89	83	77	97	I
Engine Generator Set (350kVA)	50%	680	106	114	114	103	108	111	106	104	101	95	89	109	I
Portable Generator (4KW)	50%	8	94	102	102	91	96	99	94	92	89	83	77	97	I
Portable Generator (10KW)	50%	30	94	102	102	91	96	99	94	92	89	83	77	97	I
Light Plant (6KW)	6%	10	90	98	98	87	92	95	90	88	85	79	73	93	XII

The “Source” column to the far right of Table 2 refers to the reference for the sound power data, shown in the list below:

I: Roadway Construction Noise Model v1.0 User Guide, Table 9.1
II: RCNM Table 9.5
III: RCNM Table 9.6
IV: RCNM Table 9.8
V: RCNM Table 9.9
VI: Assumed to be the same as Dump Truck
VII: Ross & Staiano, Noise Con2007
VIII: Based on California Off Highway Vehicle noise limit

IX: Yale Forklift Trucks Specifications
X: Liebherr TL442-13 Specifications
XI: Assumed to be the same as Manlift
XII: Multiquip LT-12 Specifications

Sound power levels were calculated from the overall sound pressure level data using an industry-accepted conversion formula. Octave band values were derived from the overall sound power based on diesel engine noise estimation techniques described by Beranek & Ver (1992). Note that the usage factors from the above Table 2 may, in some cases, be different from conservative duty cycle percentage values assumed in the previous spreadsheet models. The reader may refer to Appendix F from the Supplemental Filing for a list of the earlier overall A-weighted decibel values and usage factors for each piece of equipment.

3.1.2.2.2 Construction Equipment Positioning

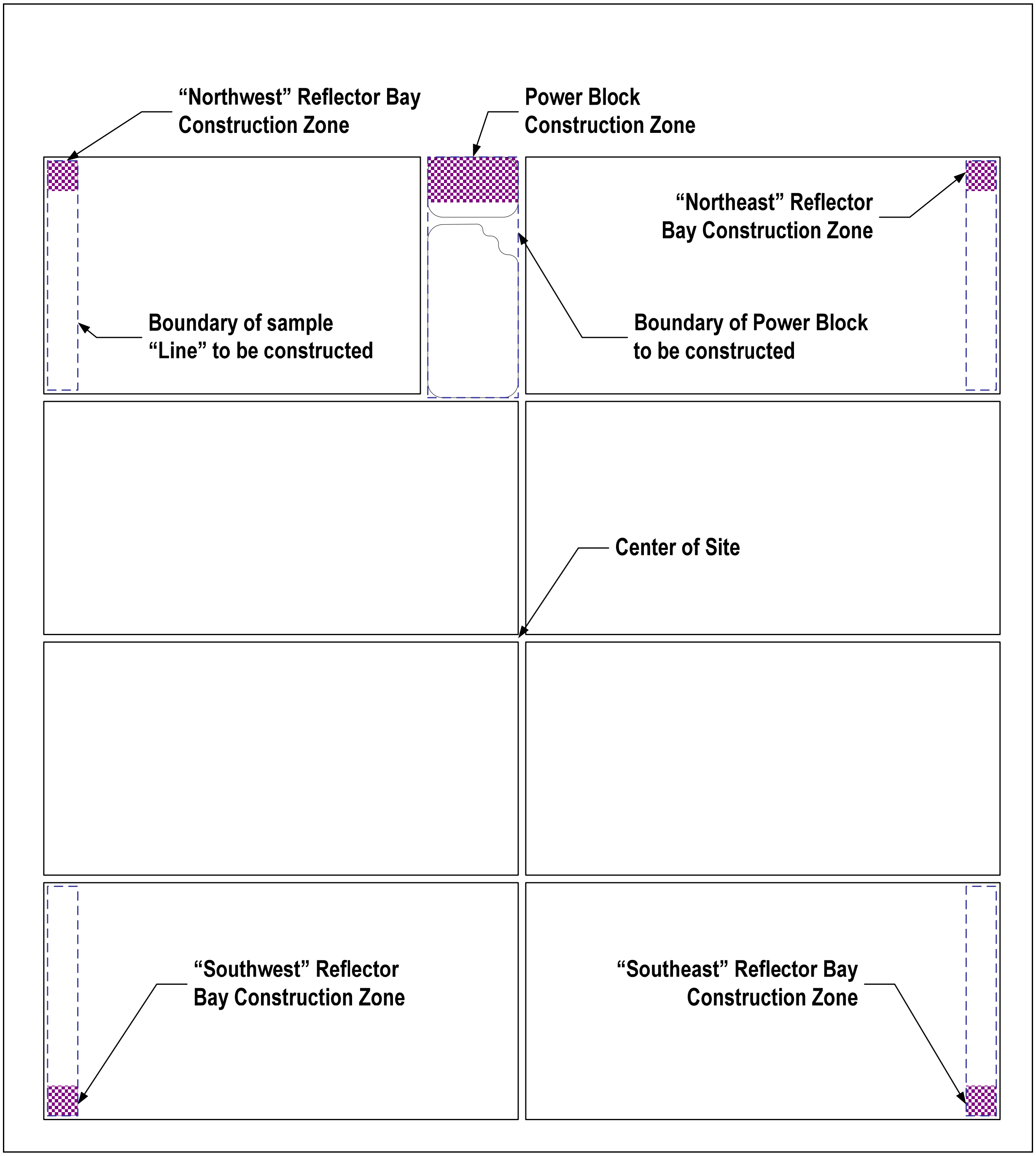
From the AFC Project Description Table 3.4-10, the construction and commissioning of the Project will occur in the following order: Steam Field #1, Power Block #1, Steam Field #2 and Power Block #2.

While the estimated monthly roster of construction equipment quantity for the entire 35-month project construction duration is known, there is no specified exact correlation between the above three milestones and generalized activities or phases such as: site preparation and grading, concrete pours, structural steel, mechanical, clean-up and steam blows. Hence, with respect to where construction equipment might be located, the model will assume that for each month of the construction schedule there will be equipment at the following construction zones or acoustic centers:

- **Power Block** – a 300’ deep by 500’ wide area on which a portion of the structures and systems associated with the Power Block would be constructed. This zone would be expected to move with Project construction progress, resulting in a worst case that would have it positioned with a long edge sharing the northern-most edge of the Project.
- **Reflector Bays** – a 200’ deep by 200’ wide area on which up to six reflector “bays”, piping and motor systems would be constructed at a time. The Cadna/A® model has several of these potential zones located at different positions across the Project site.
- **Center of Site** – an acoustic center, like the spreadsheet model point source but instead defined as a large area across the entire Project site.
- **Onsite Manufacturing Facility (OMF) –** a zone corresponding with a 50’-wide perimeter surrounding and including the OMF building in which reflector assemblies are produced prior to installation on the Project site.
- **Staging Area –** a zone corresponding with the like-named area in Supplemental Figure 1.4-1.

For illustration purposes, Figure 4 displays these zones in plan view. While it is understood that Reflector installation will likely occur one “line” at a time, these lines are arranged in a north-south orientation. This means that the Reflector Bay construction zone as described above would define a short period of time where construction activity would be concentrated—rather than spread across an area of an entire line footprint.

Figure 4
Positions of Construction Zones on Project Site



The Cadna/A® model distributes equipment among these five zones as follows:

- **Center of Site** – ATVs and pick-up trucks, used to transport personnel and materials, could conceivably be located anywhere on the Project site at any one time. They would therefore, not be restricted to a specific construction zone.
- **Onsite Manufacturing Facility –** essentially the same set of equipment described in the Supplemental Filing, slightly modified to reflect current Applicant estimates of anticipated construction equipment and summarized below in Table 3 for convenience:

Table 3
Anticipated Construction Equipment Utilized by Onsite Manufacturing Facility

Equipment Description	Projected Monthly Construction Equipment Use-Months																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Pick-up truck (1/2 ton)	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
ATV	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
Hydraulic Mobile Crane (15 ton)	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Telescopic Handler 4 ton	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Air compressor - Electric (250 CFM)	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Engine Generator Set (30kVA)	0	0	0	0	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
Light Plant (6KW)	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Total Equipment	**0**	**0**	**0**	**0**	**9**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**0**	**0**	**0**	**0**

- **Staging Area –** the 20-seat and 50-seat buses are not expected to traverse the Project site and would remain in the Staging Area to pick up and drop off passengers when idling and producing noise.
- **Power Block and Reflector Bays** – all equipment appearing in the roster for a given month, aside from exceptions described above, would either be located here or at the Reflector Bays. The proportion of equipment quantities between the Power Block and the Reflector Bays is unknown but considered as part of the mitigation Scenario analyses.

While the exact ratio is unknown at this time and would likely change during the course of the Project's construction, for DNMP analysis purposes the proportion of equipment at the Power Block compared to that at the Reflector Bay zones could respect an "80/20" rule. In other words, eighty percent of equipment quantity will be assumed to be at the Power Block, while the remaining twenty percent will be located at one or more of the Reflector Bay zones appearing in Figure 4.

If one were to assume a worst case, all equipment assigned to Reflector installation would be located at only one zone. To assess where such concentration of construction intensity at a single Reflector zone would cause the most aggregate noise, the Cadna/A® modeling process examines different cases that are described in the Scenarios section.

Because the equipment quantities vary from month to month, review of the 35-month schedule suggests that there is a "worst case" month based on a comparison of aggregate sound power level for all construction equipment by month. All else being equal for each studied case, the modeled "worst case" or noisiest month would be louder than other months based on differences of aggregate sound power level. Put another way, Table 4 shows how much quieter the predicted construction noise level of other months are expected to be based on these aggregate differences.

Table 4
Predicted Overall dBA Difference from Loudest Construction Month

Month	Δ dBA	Month	Δ dBA	Month	Δ dBA
1	-3	13	-3	25	-4
2	-2	14	-3	26	-5
3	0	15	-3	27	-5
4	0	16	-3	28	-5
5	0	17	-4	29	-5
6	-1	18	-3	30	-6
7	-1	19	-4	31	-6
8	-3	20	-4	32	-7
9	-3	21	-4	33	-7
10	-3	22	-4	34	-4
11	-3	23	-4	35	-5
12	-3	24	-4		

Based on these data, the "loudest" months of construction activity are expected to occur during months 3, 4, and 5. The influence of these monthly differences will be exhibited in the Prediction Results section of this DNMP.

3.1.2.2.3 Steam Blows

Typically, the loudest noise encountered during construction, inherent in building any project incorporating a steam turbine, is created by the steam blows. After erection and assembly of the feed water and steam systems, the piping and tubing that comprises the steam path has accumulated dirt, rust, scale, and construction debris such as weld spatter, dropped welding rods, and the like. If the plant were started up without thoroughly cleaning out these systems, all this debris would find its way into the steam turbine, quickly destroying the machine.

In order to prevent this, before the steam system is connected to the turbine, the steam line is temporarily routed to the atmosphere. Traditionally, high-pressure steam is then raised in the heat recovery steam generator or a temporary boiler and allowed to escape to the atmosphere through the steam piping. This flushing action, referred to as a "high pressure steam blow," is quite effective at cleaning out the steam system. A series of short steam blows, lasting two or three minutes each, is performed several times daily over a period of two or three weeks. At the end of this procedure, the steam lines are connected to the steam turbine, which is then ready for operation.

High-pressure steam blows, if unsilenced, can typically produce noise levels as high as 129 dBA at a distance of 50 feet. With a silencer installed on the steam blow piping, noise levels are commonly attenuated to 89 dBA at 50 feet.

A quieter steam blow process, referred to as low pressure steam blow and marketed under names such as QuietBlow™ or Silentsteam™, has become popular. This method utilizes lower pressure steam over a continuous period of 36 hours or so. Resulting noise levels reach about 80 dBA at 100 feet.

Table 4-4 presents the predicted sound levels at each receiver from the nearest potential steam blow location. For purposes of analysis, a nearest location is assumed to be one of the eight steam drums positioned in the solar field. Note that the air/ground absorption (1 dB per 1,000 feet) was taken into account for this prediction.

Table 5
Steam Blow Noise Prediction

Receivers	Ambient Leq (dBA)	Distance to the Nearest Steam Blow Location (feet)	High Pressure Steam Blow (129 dBA at 50')	High Pressure with Silencer (89 dBA at 50')	Low Pressure Steam Blow (80 dBA at 100')
ML1	48	4,461	86	46	43
ML3	35	5,248	83	43	40
ML7	43	15,744	63	23	20
SR10	50	2,460	93	53	50
LT01	47	5,740	82	42	39
Strobridge	33	4,592	85	45	42
Bell Future	30	8,528	76	36	33
Bell Existing	30	10,496	72	32	29
Reyes	37	3,608	88	48	45

As shown in Table 5, the increase of sound levels over ambient at each receiver would be less than 10 dBA with low pressure steam blow methodology.

3.1.2.2.4 Pile Driving

Pile-driving was a 3-month construction activity (*i.e.*, months 3, 4 and 5 in the 35-month estimated duration) considered part of the overall equipment roster. After consideration by the Applicant, alternative construction techniques will be employed and the need for pile driving and its associated equipment has been eliminated.

3.1.2.2.5 Concrete Pours

As indicated in the PSA, concrete pouring for foundations would be expected at the power block and could start as early as 5 AM in the morning. Since the hours between 5 AM and 7 AM can sometimes be considered "nighttime", this DNMP includes a potential impact assessment with respect to projected noise associated with concrete pours and ambient nighttime sound levels. Table 6 presents the prediction results of concrete pouring activity at two locations: 1) the power block (PB), and 2) the on-site manufacturing facility (OMF) that also has—but perhaps not to the same extent—a concrete foundation. It was assumed that one concrete pump truck and associated vehicles (2 pick-up trucks and 2 ATVs) would represent the typical crew performing this work at the indicated location. Source sound level data shown in Table 2 for these vehicles was utilized for this analysis. Note, however, that the utilization factor of the concrete pump truck was assumed to be 100% to assess the worst-case: that during one of these early-morning hours of 5 AM or 6AM, the concrete truck would be active for the entire sample hour.

Table 6
Nighttime Concrete Pouring Noise Prediction

Receivers	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)		Cumulative (dBA)		Increase over Ambient (dBA)	
			PB	OMF	PB	OMF	PB	OMF
ML1	43	27	24	25	43	43	<1	<1
ML3	32	28	27	18	33	32	1	<1
ML7	40	12	5	9	40	40	<1	0
SR10	50	36	27	31	50	50	0	<1
Strobridge	24	33	34	19	34	25	10	1
Bell Future	25	20	20	15	26	25	1	<1
Bell Existing	25	17	17	13	26	25	<1	<1
Reyes	33	27	32	21	36	33	3	<1

Notes:
PB = Power Block
OMF = Onsite Manufacturing Facility

As shown in Table 6, the projected increase of sound level over ambient at Strobridge is 10 dBA and indicates the potential need of either Scenario 2 or 3 (each as described in Section 3.1.3) in order to reduce predicted cumulative noise to less than a 5 dBA increase over ambient sound.

Concrete pours represent a construction activity that is considered time critical and may require limited nighttime hours as discussed above. In the PSA, other sample potential nighttime activities are presented that might also require extension of work hours outside of the normal daytime period based on inherent process requirements or material driven characteristics. Consistent with earlier estimates, such potential temporary nighttime construction activity is expected to require no more than 10% of the daytime construction equipment intensity and hence would have a predicted noise level of at least 10 dBA less than the daytime construction noise estimate. The aforementioned concrete pour analysis, for instance, agrees with this estimate. Under these conditions, the PSA indicates that impacts are considered less than significant so long as conditions of certification NOISE-1, -2 and -6 are honored. The Applicant intends to do so.

3.1.2.2.6 Receivers

Receivers are depicted as location points in the model space that correspond with positions near an actual or planned residence. For purposes of this DNMP, the list of studied receivers are known and have been identified in previous documents as follows: ML1, ML3, ML7, SR10, LT01, Strobridge, Bell Future, Bell Existing, and Reyes. It is understood that while there may be other receivers in the vicinity, those listed above could be considered representative for others that share the same approximate distance and direction to the Project.

3.1.2.2.7 Air & Ground Effects

The reader should note that in all cases for the modeled Scenarios, air and ground absorption effects are included, which as previously mentioned in subsection 3.1.1, are part of the Cadna/A® calculation algorithm per ISO 9613-2 standards. Inputs for these sound attenuating air and ground effects are quantified as follows:

- Air temperature = 10^{o} C
- Humidity = 70 %
- Windspeed = 0 mph
- Project Site ground absorption coefficient = 0.25
- Vicinity ground absorption coefficient = 0.75

While temperature and humidity in the site vicinity can range between different daily and seasonal extremes, the values shown above are conservative with respect to sound attenuation from air absorption. Audible sound, particularly of higher frequencies, travels farther when there is more moisture in the air. Hence, air absorption is relatively poor in a moist climate with high humidity but better in a dryer climate. Quantifying the potential decibel variance of air absorption due to variances in temperature and humidity also depends on the distance that sound must travel between source and receiver. For this analysis, after running a few test cases with Cadna/A®, preliminary results showed that a climate with higher humidity (*e.g.,* 5^{o} C at 90% humidity) would add less than 1 dBA to the predicted results based on the above input parameters. Warmer, dryer conditions (*e.g.,* 20^{o} C at 10% humidity), on the other hand, would reduce predicted noise levels by over 3 dBA.

With respect to ground absorption, the coefficient values can range from zero (0), representing a hard, acoustically reflective surface such as smooth concrete or glass, to unity (1) which would represent a porous surface such as loose, tilled soils and vegetative ground cover. While the Project site might initially be described as being covered by vegetation, the ground surface will undergo transformation due to construction activity and likely result in exposed but possibly a mix of packed and unpacked dirt; hence, the value of 0.25 is considered an appropriate average leaning towards the zero end of the range. On the other hand, ground surface surrounding the Project would remain agricultural in nature (*e.g.,* tilled soil with or without the presence of vegetation) or undisturbed grassland and hence be conservatively expected to have an average coefficient of about 0.75.

3.1.3 Scenarios

Several options for mitigating construction noise were considered. Based on preliminary modeling, the following three options—in contrast to a no-mitigation baseline called “Scenario 1”—were selected for detailed analysis:

Scenario 2. Attenuate the construction equipment engines;
Scenario 3. Install a temporary barrier at the Power Block and Reflector Bay; and
Scenario 4. Both 1 & 2 above.

3.1.3.1 Construction Noise Mitigation Option Details

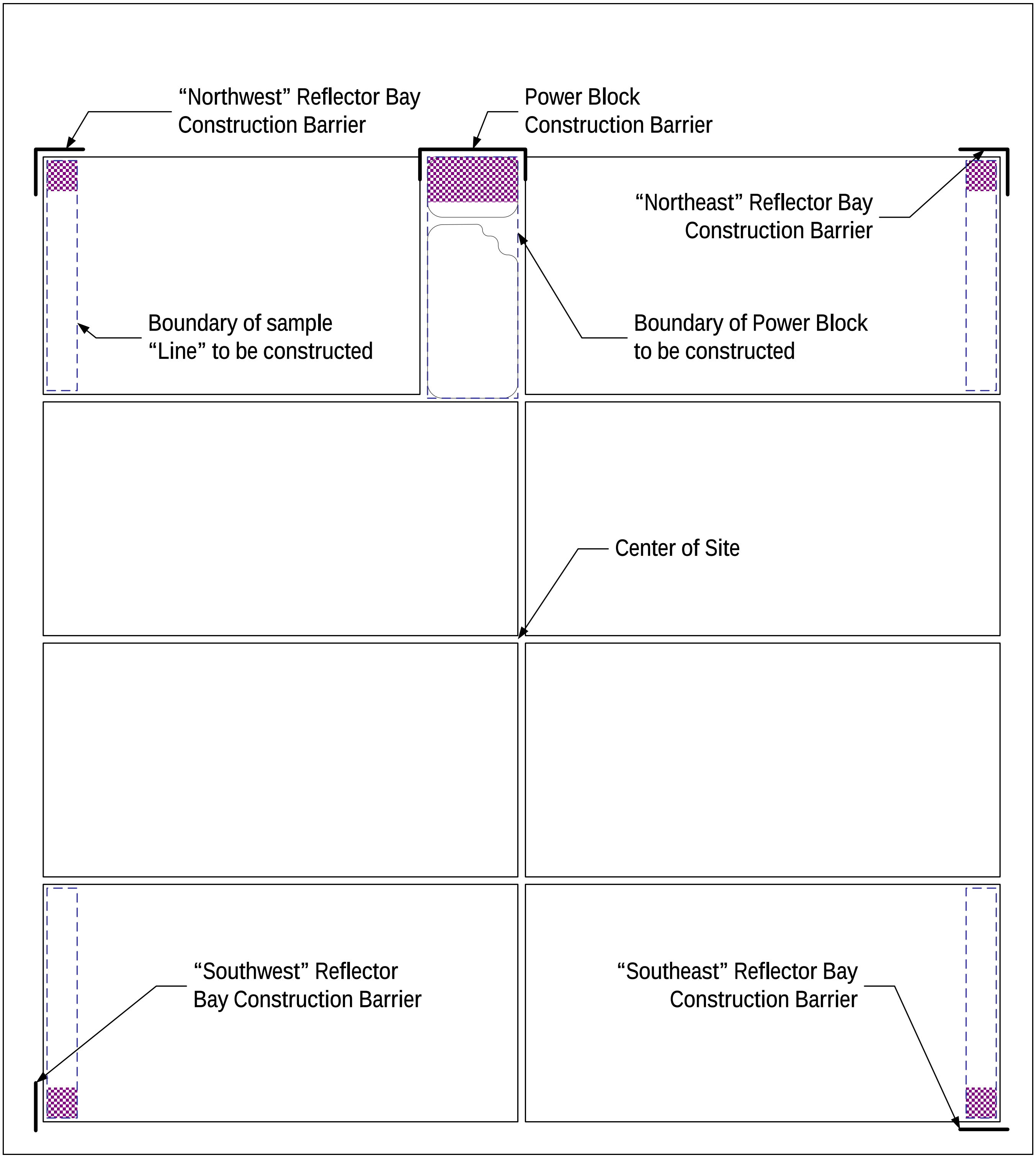
3.1.3.1.1 Sound Barrier

Detailed modeling analysis revealed that construction activities at two locations were the primary sources of noise impacts at the sensitive receptor locations. Sound barriers were evaluated as a means of path mitigation to reduce the noise levels from construction activities reaching the sensitive receptors. These barriers are temporary, portable, barriers that can be strategically located as construction activities change in order to provided optimal noise attenuation.

- **Power Block construction zone barrier**. This is a 10' tall barrier composed of movable segments, such as representative examples known as "LSE Portable" offered and supplied by Soundfighter Systems. The aggregate length of the barrier, having a U-shape layout with endwalls pointing southward, would be approximately 1,300 feet per the expressions shown in Figure 2. This is a significant distance, but necessary in order to provide meaningful NR for a construction zone that can extend as far back as the southern end of the intended Power Block area.
- **Reflector Bay construction zone barrier**. This is also a 10' tall barrier composed of portable segments, with an aggregate length and layout shape that may vary with Reflector Bay construction zone location and needs on the jobsite (*e.g.*, access of construction equipment to the bays or line being installed).

Figure 5 shows sample barrier locations that were considered in the model. It is assumed that at any one time during the Project construction, there would be one Reflector Bay barrier somewhere onsite in addition to the Power Block barrier that would not be expected to move. The lengths of the Reflector Bay barriers range from 300' to 650'.

Figure 5
Sample Reflector Bay Construction Zone Barrier Locations Studied in Predictive Analyses



While the different Scenarios and their composite cases may have the barriers at different locations, the height of these two barriers is expected to remain unchanged. However, the modeled barrier heights assume the engine noise sources are at an average elevation of 6’ above grade, resulting in a ΔH of 4’. If actual source heights of individual equipment are greater, then the barrier height should be raised to keep the same ΔH and hence preserve originally intended noise reduction.

3.1.3.1.2 Construction Engine Equipment Attenuation

Section 2.1.2 already describes the form of conventional intake, exhaust and casing noise reduction means that are expected for this option. While an exhaust muffler can deliver double-digit dynamic insertion loss (DIL) at several audible octave band center frequencies, such silencing only influences the exhaust noise component. The same can be said for a filter/silencer on the intake, and noise abatement for the engine casing. In the Cadna/A® modeling assumptions, a conservative 5 dB was applied to each octave band center frequency.

3.1.3.1.3 Construction Noise Analysis Scenarios

In addition to the no-mitigation baseline called Scenario 1, each of the three mitigation scenarios, (2) Attenuate the construction equipment engines, (3) Install a temporary barrier at the Power Block and Reflector Bay, and (4) Both 2 & 3, requires analysis of different cases due to the alternatives for Reflector Bay construction zone intensity. For each Scenario, there are five cases to be considered as follows:

A. Power Block (100%)
B. Power Block (80%) and Southwest Reflector Bays (20%)
C. Power Block (80%) and Northwest Reflector Bays (20%)
D. Power Block (80%) and Northeast Reflector Bays (20%)
E. Power Block (80%) and Southeast Reflector Bays (20%)

In total (including the baseline [Scenario 1, No Mitigation] case), there are twenty cases to consider in the predictive analysis, with results detailed in the subsequent Section 3.1.4.

3.1.4 Results

Tables 7 through 10 show the predicted construction noise levels for the five cases described in Section 3.1.3.1.3 for each of the four Scenarios.

Table 7
Predicted Construction Noise, Loudest Month, *Scenario 1: No Mitigation*

Reciever	Ambient Leq (dBA)	Predicted Construction Noise Leq (dBA)					Cumulative Leq (dBA)					Increase Over Ambient (dBA)				
		Reflector Bay Construction Zone Cases														
		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
ML1	48	42	45	42	41	41	49	50	49	49	49	<1	2	1	<1	<1
ML3	35	44	43	43	45	43	44	44	44	46	44	9	9	9	11	9
ML7	43	22	24	21	24	25	43	43	43	43	43	0	0	0	<1	<1
SR10	50	45	54	45	44	45	51	56	51	51	51	1	6	1	1	1
LT01	47	35	38	35	35	42	47	48	47	47	48	<1	<1	<1	<1	1
Strobridge	33	51	50	50	50	50	51	50	50	50	50	18	17	17	17	17
Bell Future	30	37	37	38	36	36	38	38	38	37	37	8	8	8	7	7
Bell Existing	30	34	34	35	34	34	36	36	36	35	35	6	6	6	5	5
Reyes	37	50	49	49	51	49	50	49	49	51	49	13	12	12	14	12

Table 8
Predicted Construction Noise, Loudest Month, *Scenario 2: Attenuate Equipment Engines*

Reciever	Ambient Leq (dBA)	Predicted Construction Noise Leq (dBA)					Cumulative Leq (dBA)					Increase Over Ambient (dBA)				
		Reflector Bay Construction Zone Cases														
		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
ML1	48	37	40	37	36	36	48	49	48	48	48	<1	<1	<1	<1	<1
ML3	35	39	38	38	40	38	40	40	40	42	40	5	5	5	7	5
ML7	43	17	19	16	19	20	43	43	43	43	43	0	0	0	0	0
SR10	50	40	49	40	39	40	50	53	50	50	50	<1	2.7	<1	<1	<1
LT01	47	30	33	30	30	37	47	47	47	47	47	<1	<1	<1	<1	<1
Strobridge	33	46	45	45	45	45	46	45	45	45	45	13	12	12	12	12
Bell Future	30	32	32	33	31	31	34	34	34	34	34	4	4	4	4	4
Bell Existing	30	29	29	30	29	29	33	33	33	32	32	3	3	3	2	2
Reyes	37	45	44	44	46	44	45	44	45	47	45	8	7	8	10	8

Table 9
Predicted Construction Noise, Loudest Month, *Scenario 3: Temporary Barriers*

Reciever	Ambient Leq (dBA)	Predicted Construction Noise Leq (dBA)					Cumulative Leq (dBA)					Increase Over Ambient (dBA)				
		Reflector Bay Construction Zone Cases														
		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
ML1	48	42	42	42	41	41	49	49	49	49	49	<1	1	<1	<1	<1
ML3	35	39	39	39	41	39	41	40	40	42	41	6	5	5	7	6
ML7	43	22	24	21	22	25	43	43	43	43	43	0	0	0	0	<1
SR10	50	45	50	45	44	45	51	53	51	51	51	1	3	1	1	1
LT01	47	35	38	35	35	39	47	48	47	47	48	<1	<1	<1	<1	<1
Strobridge	33	46	45	46	46	45	46	45	46	46	45	13	12	13	13	12
Bell Future	30	32	32	33	33	32	34	34	35	34	34	4	4	5	4	4
Bell Existing	30	30	30	30	30	30	33	33	33	33	33	3	3	3	3	3
Reyes	37	45	44	44	47	44	45	45	45	47	45	8	8	8	10	8

Table 10
Predicted Construction Noise, Loudest Month, ***Scenario 4: Attenuate Engines & Use Barriers***

Reciever	Ambient Leq (dBA)	Predicted Construction Noise Leq (dBA)					Cumulative Leq (dBA)					Increase Over Ambient (dBA)				
		Reflector Bay Construction Zone Cases														
		A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
ML1	48	37	37	37	36	36	48	48	48	48	48	<1	<1	<1	<1	<1
ML3	35	34	34	34	36	34	38	37	38	38	38	3	2	3	3	3
ML7	43	17	19	16	17	20	43	43	43	43	43	0	0	0	0	0
SR10	50	40	45	40	39	40	50	51	50	50	50	<1	1	<1	<1	<1
LT01	47	30	33	30	30	34	47	47	47	47	47	<1	<1	<1	<1	<1
Strobridge	33	41	40	41	41	40	42	41	41	41	41	9	8	8	8	8
Bell Future	30	27	27	28	28	27	32	32	32	32	32	2	2	2	2	2
Bell Existing	30	25	25	25	25	25	31	31	31	31	31	1	1	1	1	1
Reyes	37	40	39	39	42	39	42	41	41	43	41	5	4	4	6	4

Highlighted "Increase Over Ambient" values in Tables 7 through 10 indicate where predicted Cumulative levels are greater than 10 dBA over current ambient sound levels at the studied noise-sensitive receivers. As shown in Table 10, the incorporation of noise barriers and engine attenuation reduces the increase in noise levels to less than 10 dBA above existing ambient conditions.

Because Tables 7 through 10 consider only noise levels during the loudest months of construction, the following Figures illustrate a sample of how the monthly construction noise levels are anticipated to change over the course of construction. Figures 6 through 14 present graphs of predicted cumulative sound levels at each studied noise-sensitive receiver for the four Scenarios (No Mitigation Scenario and the three mitigation scenarios) with all equipment at the Power Block. Each graph has been formatted to display the current ambient daytime noise level (L_{eq}) on the Y-axis. The base of the Y-axis corresponds to the daytime ambient noise level at the respective locations. The horizontal lines on the graphs correspond to noise levels that are 5, 10, or 15 dBA greater than the current ambient noise levels. Hence, the reader can quickly assess which scenarios are predicted to have cumulative sound levels (*i.e.*, the logarithmic combination of current ambient plus predicted Project construction noise) that comply with these thresholds for each month.

Figure 6
Predicted Cumulative Sound During Construction of Project at ML1 (case B)

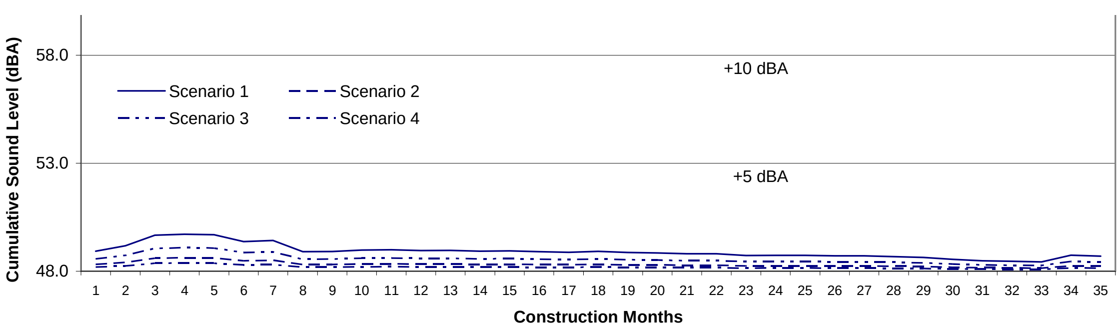


Figure 7
Predicted Cumulative Sound During Construction of Project at ML3 (case D)

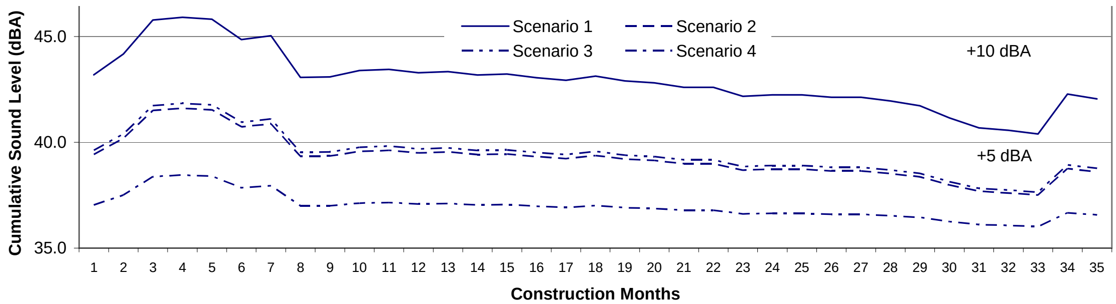


Figure 8
Predicted Cumulative Sound During Construction of Project at ML7 (case E)

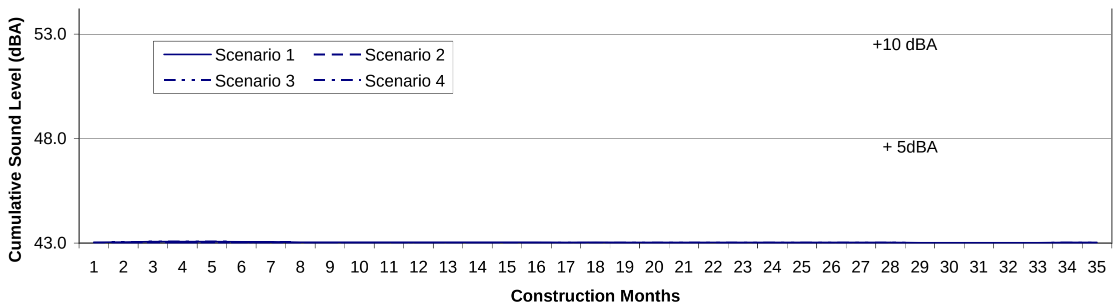


Figure 9
Predicted Cumulative Sound During Construction of Project at SR10 (case B)

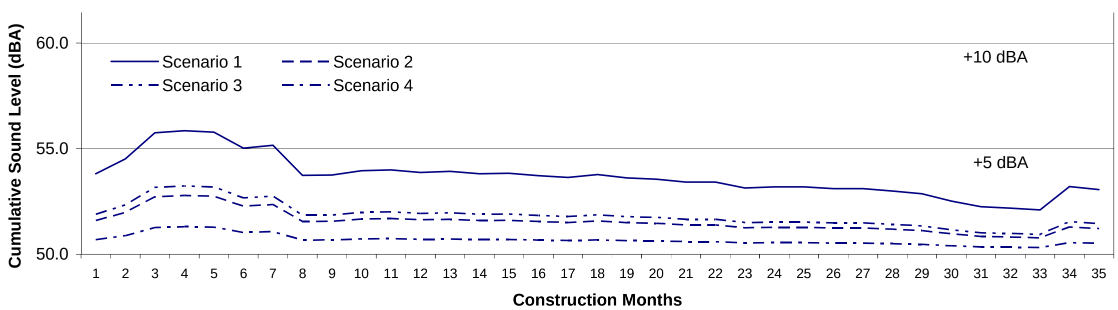


Figure 10
Predicted Cumulative Sound During Construction of Project at LT1 (case E)

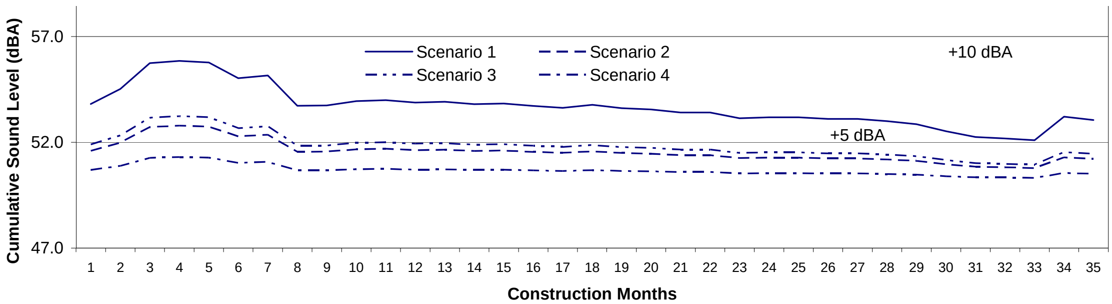


Figure 11
Predicted Cumulative Sound During Construction of Project at Strobridge (case A)

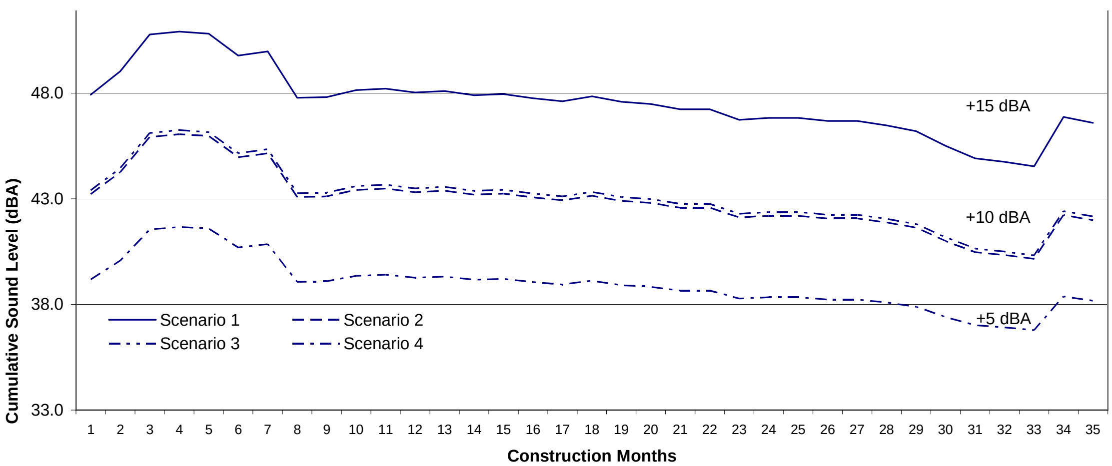


Figure 12
Predicted Cumulative Sound During Construction of Project at Bell Future (case C)

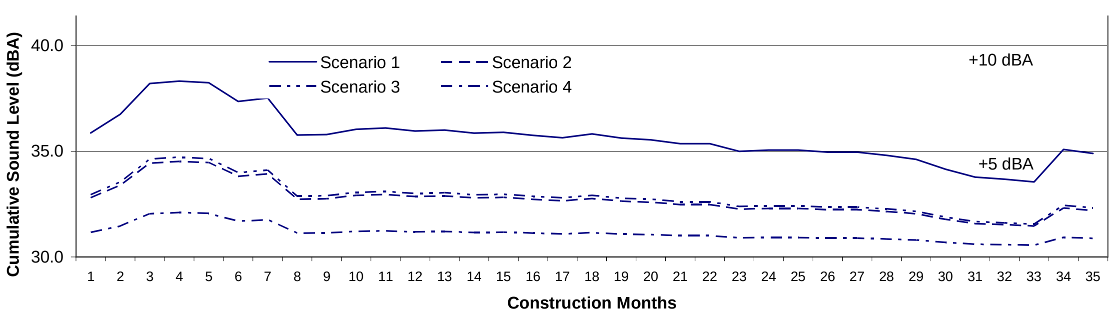


Figure 13
Predicted Cumulative Sound During Construction of Project at Bell Existing (case C)

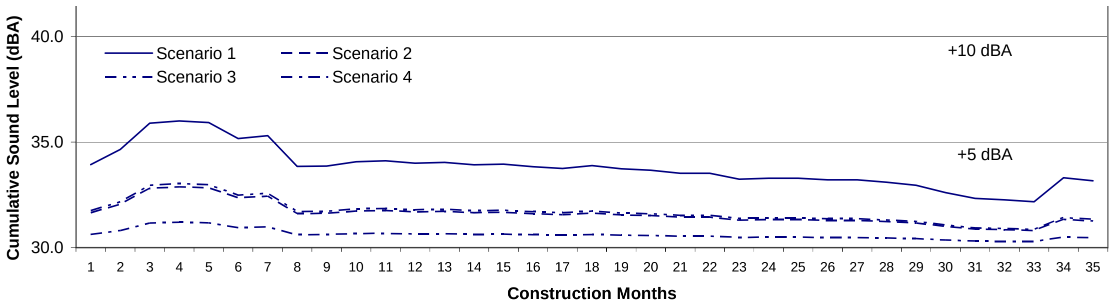
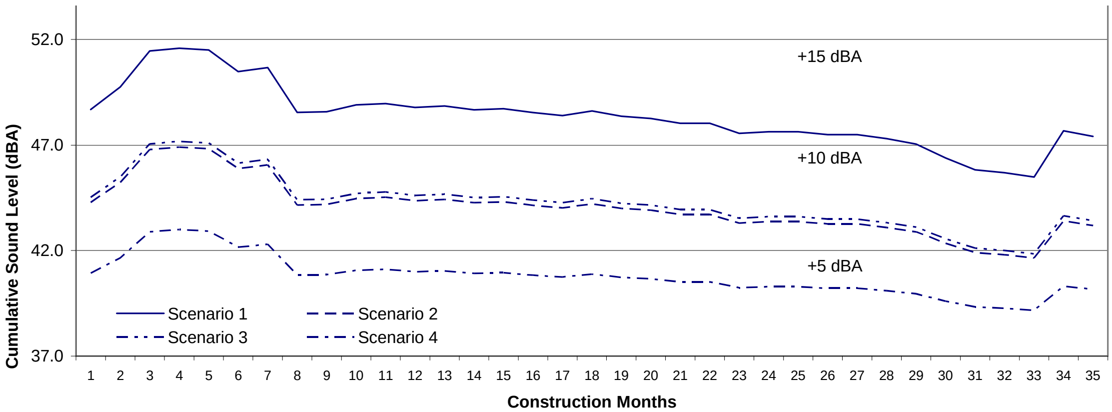


Figure 14
Predicted Cumulative Sound During Construction of Project at Reyes (case D)



Of particular note is that Figure 11 shows that either Scenarios 2 or 3 appear capable of providing a projected increase over ambient no greater than 10 dBA for the latter half of the 35-month Project construction duration. Scenario 4, the combination of both barrier and engine attenuation options provides less than 10 dBA projected increase for the entire 35-month period and even appears to permit 5 dBA or less increase for the final months of construction as modeled.

The graphs are similar in shape due to the monthly adjustments of Table 4 applied to each of the worst-month cases modeled in Cadna/A®. To help confirm this approach, a quieter month (*e.g.*, 30) was actually modeled in Cadna/A®, with predicted results in very close agreement to these aggregate-based adjustment factors.

3.2 PROJECT OPERATION NOISE ANALYSIS

3.2.1 Methodology

In a manner similar to the operational noise modeling technique used for the AFC, the Project operations noise prediction model for this DNMP utilizes the same Cadna/A® software program that was utilized for early estimates prepared for the original AFC and Supplemental Filings.

To better understand the specifics of how operation noise is analyzed in Cadna/A® for this DNMP, for both daytime and nighttime conditions, the following subsection describes the Baseline model and its underlying parameters and assumptions. These Baseline model parameters are then compared with prior model parameters in order to explain adopted improvements and refinements to the predictive analysis. Subsequently, a number of Scenarios are described that represent major and minor changes to the Baseline model for purposes of evaluating the combined effect of one or more previously described mitigation options.

3.2.2 Baseline

The Baseline modeling assumptions are summarized in the following subsections. This review will help discern what noise reducing means and methods have already been incorporated into the current project design, and are therefore unavailable for consideration.

3.2.2.1 Model Space

The Project area and its vicinity, up to approximately 2 miles distant from the Project boundary, was defined by the following available information:

- Topographical data at 15' gradient resolution.
- Receiver locations as defined by County records (*e.g.*, issued permits, APN parcel numbers) and supported by survey observations that include GPS data.

3.2.2.2 Sources

Similar to Table 5.12-6 of the AFC, Table 11 shows the list of sound power levels, per octave band, for sources considered in the daytime Project operational noise model.

Table 11
Operational Source Sound Power Levels

ID	Equipment List	Quantity	31.5	63	125	250	500	1000	2000	4000	8000	Awt	Atten.	Type	Height (m)	Source
1	ACC top	2	119	116	116	112	110	107	102	96	91	112	3	Area	21	I
2	ACC low	2	119	116	116	112	110	107	102	96	91	112	3	Area	18	I
3	Steam Turbine Generator	2	111.9	117.9	115.9	110.9	106.9	102.9	99.9	91.9	85.9	109	wall	V. Area	18.28	II
4	Air Compressor	2	94	90	95	94	92	95	100	97	90	104	wall	V. Area	18.28	II
5	Transformer	2	108	111	105	105	100	94	91	88	88	102		V. Area	9.14	II
6	Auxiliary Transformer	1	90.8	96.8	98.8	93.8	93.8	87.8	82.8	77.8	70.8	94		V. Area	4.58	II
7	Fire Water Pump	1	67.3	69.2	80.4	89.9	97.1	102.2	104.9	101.8	97	109	wall	Point	1.5	III
8	Feed Water Pump	4	97	103	101	100	99	98	97	96	92	104	9	Point	1.5	II
9	Emergency Gen. (Mechanical)	1	34.5	112.4	125	122.2	116.5	117.4	116.1	111.2	109.1	123	wall	Point	2.5	IV
10	Emergency Gen. (Exhaust)	1	8	109.3	128.9	130.7	120	116.4	115.1	105	90.3	125	wall	Point	2.5	IV
11	Air Condition (5-ton)	2			62.5	67.5	71	68	67	63.5	54.5	74		Point	0.2	V
12	Air Condition (1-ton)	2			51	57	62	62.5	62	56.5	47.5	67		Point	0.2	V
13	Fan	24		96	101	91	85	78	72	66	62	89		Point	0.2	VI
14	Refrector Positioning Motor	8		53.8	56.7	56.7	56.5	53.4	50	46.6	36.7	63		Area	2	II
15	2" pipe receiver	195	91	89	88	86	85	76	67	59	50	84		Line	17	VII
16	6" pipe collector	9	111	109	109	109	101	92	83	75	66	103	10	Line	0.74	VII
17	Building Insulation				13	16	25	32	37	46						VIII

I: SPX Cooling Technologies, Inc September 2007
II: Edison Electronic Institute
III: Clarke Fire Pump Driver JW6H-UF40
IV: Caterpillar C32
V: Carrier Model Specifications
VI: COOK Series 030 Panel Venturi Fan
VII: Bies & Hansen, Engineering Noise Control, 2003
VIII: NAIMA R10 Faced 202-96

3.2.2.3 Receivers

The set of studied receivers include those already considered for the construction noise modeling.

3.2.2.4 Air & Ground Effects

The reader should note that in all cases for these operational noise Scenarios, air and ground absorption effects are included, which as previously mentioned in subsection 3.1.1, are part of the Cadna/A® calculation algorithm per ISO 9613-2 standards. Inputs for these sound attenuating air and ground effects are quantified as follows:

- Air temperature = 10° C
- Humidity = 70 %
- Windspeed = 0 mph
- Project Site ground absorption coefficient = 0.25
- Vicinity ground absorption coefficient = 0.75

With respect to ground absorption, the coefficient values can range from zero (0), representing a hard, acoustically reflective surface such as smooth concrete or glass, to unity (1) which would represent a porous surface such as loose, tilled soils and vegetative ground cover. While the Project site might initially be described as being covered by vegetation, then converted to exposed but unpacked dirt as a result of grading, the final Project site ground surface will be a mix of loose soil and concrete pads on which the Reflectors are to be installed; hence, the value of 0.25 is considered a conservative average leaning towards the zero end of the range. On the other hand, ground surface surrounding the Project would remain agricultural in nature (*e.g.*, tilled soil with or without the presence of vegetation) or undisturbed grassland and hence be expected to have an average coefficient of about 0.75 or the higher end of this range.

3.2.3 Baseline Model Comparison

The Cadna/A® model utilized for operation noise predictions contains a number of refinements as compared to earlier models, such as the daytime operational noise model prepared for the Supplemental Filing and the nighttime operational model prepared in response to Data Request #104. These differences, primarily with regard to how sources and obstacles were cast in the Cadna/A® model, are summarized as follows: (Note that ID numbers indicated below correspond to the column of Table 11.)

- Contradicting a prior assumption that Feedwater Pumps would be enclosed by acoustically absorptive housings or similar structures that would render their sound contribution negligible as compared to neighboring Power Block systems, Feedwater Pumps (ID #8) were added to the model. Consistent with design redundancy considerations presented in AFC Table 3.7-1, four of these pumps were included in the current Baseline model and assumed to each be operating 50% capacity.
- HVAC systems (ID #11, 12, and 13) were added when Data Request #104 was submitted. The same noise sources, located on building rooftops, are used for the current Baseline model.
- The Air Cooled Condenser (ACC) pair (ID #1 and 2) of sources was modified to better reflect the actual fan array within what amounts to a floating parapet. For instance, each ACC is now modeled with two horizontal area sources, representing the aggregate fan array intake and discharge, respectively. This approach differs from previous models, which conservatively depicted the ACC sound source as merely a floating horizontal area source. To help ensure the new approach accurately depicts the ACC sound, hypothetical receiver positions at 400' from the ACC were added to the model. Predicted levels at these close receivers appeared to match the overall dBA, including the ± 2 dBA stated margin of error, provided by the manufacturer.
- The noise from the condensate trunks that cross the top of each ACC have been excluded from the Baseline model. Previous estimates of noise from these large pipes, based on steam flow rates using industry-accepted spreadsheet based calculation tools, indicated that they would be significantly quieter than the ACC fans, which are understood to be the dominant noise generators and represented numerically by the manufacturer's data.
- In the Supplemental Filing, Steam Turbine Generator (ID #3) and Air Compressor (ID #4) were conservatively modeled as point source noise emitters, attenuated numerically by the expected transmission losses of the turbine building in which they are to be contained. This conservative modeling assumption removed the potential barrier effect afforded by an actual structure in the model. Hence, these sources are now modeled as a combined vertical area source surrounding the building structure. Note that it is also assumed that the aforementioned transmission losses, appearing as #17 in Table 11, are to be considered *field* transmission losses. As such, the Applicant will require its building contractor to provide a building wall assembly that either demonstrates these losses via testing, or tests at least 5 dB better in a laboratory setting.

3.2.4 Scenarios

The mitigation options considered for operation noise are different between the daytime and nighttime cases, as has been presented in Section 2.2.

3.2.4.1 Option Details

3.2.4.1.1 Permanent Sound Barrier

Section 2.2.1.1 describes the permanent sound barrier considered to mitigate daytime operation noise. This mitigation option was analyzed and rejected as it does not provide the required IL.

3.2.4.2 Analysis Cases

3.2.4.2.1 Daytime

Daytime operation assumes that the constructed plant is operating at full capacity under optimal solar conditions. Two cases were analyzed, differentiated by the operation of the emergency generator—a significant noise source. Such emergency equipment is usually tested with some regularity, and for the purposes of this analysis only during daytime when the plant is expected to operate and generate power.

3.2.4.2.2 Nighttime

Nighttime operation assumes that the plant is minimally operating, with building HVAC operating normally to provide needed ventilation and building occupant comfort. Feedwater pumps are expected to run at less than daytime levels, rather than 50% per daytime operating parameters. With these systems providing an expected continuous “background” noise from the Project, analysis cases involve the consideration of electric-powered vehicles and alternatives to diesel-burning generators for powering the Reflector cleaning activity portable lighting plant.

3.2.5 Results

3.2.5.1 Daytime Operation Noise

The following tables present the set of prediction results from the Cadna/A® based analyses for daytime operations. The four cases considered include no mitigation, and three different heights of the top of the water-tank barrier mitigation option. The “NOISE-4”column is provided to help illustrate that the newly predicted daytime operational levels can and do differ from the values shown in the PSA. In most cases, the predicted sound levels are actually higher than what was previously predicted.

Table 12
Predicted Operation Noise for 100% Plant Operation Capacity, Daytime, Emergency Generator Active

Reciever	Ambient Leq (dBA)		Predicted Noise Leq (dBA)				Cumulative (dBA)				Increase over Ambient (dBA)			
		NOISE-4	No Mitigation	40feet	50feet	60feet	No Mitigation	40feet	50feet	60feet	No Mitigation	40feet	50feet	60feet
ML1	48	33	37	37	37	37	48	48	48	48	0	0	0	0
ML3	35	33	34	34	34	34	38	38	38	38	3	3	3	3
ML7	43	17	22	22	22	22	43	43	43	43	0	0	0	0
SR10	50	36	41	41	41	41	50	50	50	50	0	0	0	0
LT01	47	29	33	33	33	33	47	47	47	47	0	0	0	0
Strobridge	33	39	39	38	38	37	40	39	39	39	7	6	6	6
Bell Future	30	28	31	31	31	31	34	34	34	34	4	4	4	4
Bell Existing	30	26	29	29	29	29	32	32	32	32	2	2	2	2
Reyes	37	38	38	38	38	38	41	41	41	41	4	4	4	4

Table 12 presents the predicted results for a "worst-case" involving the plant and full expected capacity. In addition, the emergency generator source is "turned on" to represent the possibility that it would be tested for a period of time while the plant is otherwise fully operational. Such emergency generator testing is expected to be very infrequent: at least 30 minutes per month, but less than a total of 30 hours per year per San Luis Obispo County guidance and as stated by the Applicant in the Supplemental Filing.

Table 13
Predicted Operation Noise for 100% Plant Operation Capacity, Daytime, Emergency Generator Inactive

Reciever	Ambient Leq (dBA)		Predicted Noise Leq (dBA)				Cumulative (dBA)				Increase over Ambient (dBA)			
		NOISE-4	No Mitigation	40feet	50feet	60feet	No Mitigation	40feet	50feet	60feet	No Mitigation	40feet	50feet	60feet
ML1	48	33	36	36	36	36	48	48	48	48	0	0	0	0
ML3	35	33	34	34	34	34	38	38	38	38	3	3	3	3
ML7	43	17	22	22	22	22	43	43	43	43	0	0	0	0
SR10	50	36	40	40	40	40	50	50	50	50	0	0	0	0
LT01	47	29	33	33	33	33	47	47	47	47	0	0	0	0
Strobridge	33	39	38	38	38	37	39	39	39	38	6	6	6	5
Bell Future	30	28	30	30	30	30	33	33	33	33	3	3	3	3
Bell Existing	30	26	28	28	28	28	32	32	32	32	2	2	2	2
Reyes	37	38	38	38	38	38	41	41	41	41	4	4	4	4

Since the emergency generator testing operation is anticipated to occur for less than 1% of daytime facility operation, the predicted results of Table 13 more accurately represent the plant running at full capacity—with the emergency generator inactive.

In either set of results, one can see that the influence of a barrier offers slight noise reduction improvement and only when the height of this barrier matches or exceeds the elevation of the ACC air intake. In other words, and consistent with barrier noise reduction principles, the barrier is more effective when it provides LOS occlusion between source and receiver.

The following list briefly discusses the predicted results of Table 13 with respect to the understood goals.

- **ML1** – The projected daytime operational noise is about 3 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be zero.

- **ML3** – The projected daytime operational noise is about 1 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be only 3 dBA or less than the 5 dBA impact criteria.
- **ML7** – The projected daytime operational noise is nearly 5 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be zero.
- **SR10** – The projected daytime operational noise is about 4 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be zero. The difference in predicted operational levels is likely due to the addition of building surfaces that reflect sound towards the south end of the Project site, along with the better representation of four feedwater pumps that contribute to the aggregate generated noise.
- **LT01** – The projected daytime operational noise is about 4 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be zero. The higher predicted level for this receiver is likely due to the addition of building surfaces that reflect sound towards the south end of the Project site, along with the better representation of four feedwater pumps that contribute to the aggregate generated noise. Even after this upward adjustment, the predicted Project daytime operation level of 33 dBA Leq is more than 10 dBA less than the average daytime Leq of 47 dBA, as measured by both the Applicant and the CEC ambient noise surveys. To help put this in perspective, the magnitude of this predicted Project daytime operation level is actually lower than the indoor 35 dBA background noise level recommended for "core learning space" (*e.g.,* school classroom) by ANSI 12.60-2002.
- **Strobridge** – The projected daytime operational noise is about 1 dBA less than the value provided in NOISE-4 of the PSA. This helps enable the predicted cumulative level to be lower than 40 dBA as directed by the PSA.
- **Bell Future** – The projected daytime operational noise is about 2 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be 3 dBA.
- **Bell Existing** – The projected daytime operational noise is about 2 dBA higher than the value provided in NOISE-4 of the PSA. However, the increase over ambient is estimated to be 2 dBA.
- **Reyes** – The projected daytime operational noise is about equal to the value provided in NOISE-4 of the PSA, and the increase over ambient is estimated to be 4 dBA.

Table 13 also shows that none of the predicted Project daytime operation levels exceed 45 dBA, the level recommended by the World Health Organization as a threshold for noise outside a bedroom.

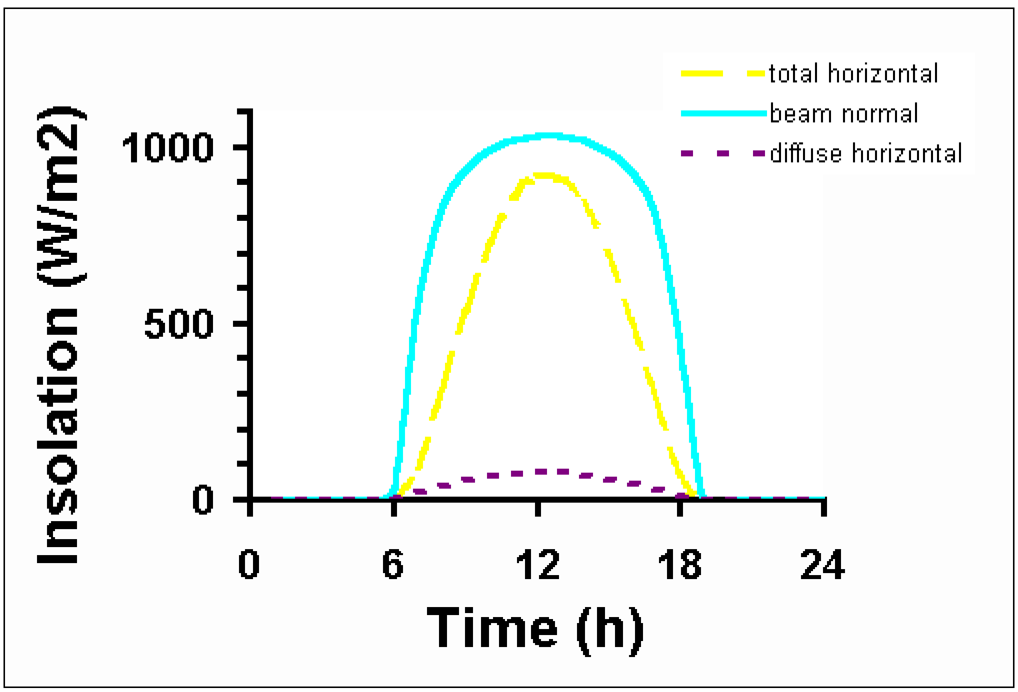
Among the representative receivers listed above and appearing in Table 13, the Strobridge, Reyes, and SR10 receivers are expected to experience the highest Project operation noise due largely to their closer proximity to the Project's dominant noise sources located at the Power Block, which is on the northern edge of the Project site. The fact that SR10, a receiver position generally southwest of the Project, is among these top three is consistent with understood principles of sound propagation: noise will emanate evenly in all directions unless influenced by factors such as wind or impeded by obstacles and other sources of acoustic reflection.

3.2.5.2 Daytime Variance

The predictive modeling for daytime operation has assumed the Project is running at full capacity and delivering at or near its maximum rated power generation of 177 MW from the combined turbines and associated Power Block systems and solar fields. Section 3.2.5.1 shows that while mitigation of daytime operation noise may be unnecessary, there would be little room for error.

However, even on a day when weather conditions are favorable and permit optimal solar insolation, the quantity of solar insolation is not constant throughout the day. Figure 15 depicts a set of curves showing variation of insolation over a full, clear day in March at Daggett, California, a meteorological measurement site close to the Kramer Junction solar power plant. The outer “beam normal” curve represents the greatest rate of incident energy on a square meter of surface area pointed toward the sun.

Figure 15
Insolation Data from Daggett, California on a Clear March Day



Source: http://www.powerfromthesun.net/chapter1/Chapter1.htm

The bottom “diffuse horizontal” curve represents scattered solar energy from “blue sky” (as one might call it) impinging on a flat surface that does not track the sun. The middle “total horizontal” curve includes diffuse horizontal energy and direct impingement from the sun.

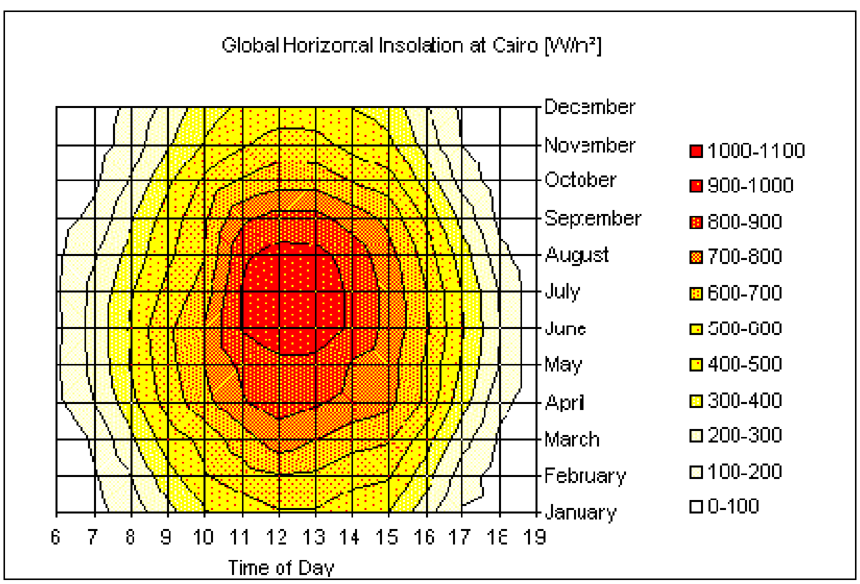
If Figure 15 were considered representative of a high solar insolation site and on that basis potentially representative of actual solar insolation anticipated for Carrizo, the sun-tracking system that is part of the Applicant’s technology should enable the Project to expect an insolation curve somewhere between the theoretical “beam normal” and “total horizontal”. Considering the former of the two, Figure 15 suggests that full insolation does not occur until late in the morning and lasts until mid-afternoon. This means that if the Project efficiency is proportionally linked to solar insolation, the fraction of full solar insolation might also describe a similar fraction of power generation with respect to the maximum rating.

If the Project does not run at full power, there are likely to be several systems that would run at slower speeds. The turbines, feedwater pumps, and ACC fans are all electromechanical equipment that feature rotating or cyclically operating components that, if running slower, should correspondingly make less noise and thus present opportunity for the predicted Project operation noise to be less than the results shown in Section 3.2.5.1.

A brief discussion with the candidate manufacturer of the ACC confirmed that the large diameter fans comprising the 20-fan arrays within each ACC could feature either two-speed motors or variable frequency drives (VFDs). The former technique could allow each fan to operate, per the control system, at either a full or reduced speed setting depending on need. The latter technique permits even more granular speed control of the fans. Either method is preferable to the alternative control scheme of individual fan shutoff, which links potential noise reduction to ten times the base-ten logarithm of the ratio of the number of operating fans over the total quantity. Speed reduction, on the other hand, can offer considerably more noise reduction as indicated by industry-accepted “fan laws” (*i.e.*, mathematical relationships that define fan performance).

In addition to daily solar insolation variance, and its potential influence on Project operation noise, solar insolation can vary by month. Intended only as an example illustration, Figure 16 shows total horizontal insolation for a sample year in Cairo, Egypt.

Figure 16
Global, Horizontal Insolation Solar Resource for Cairo Egypt



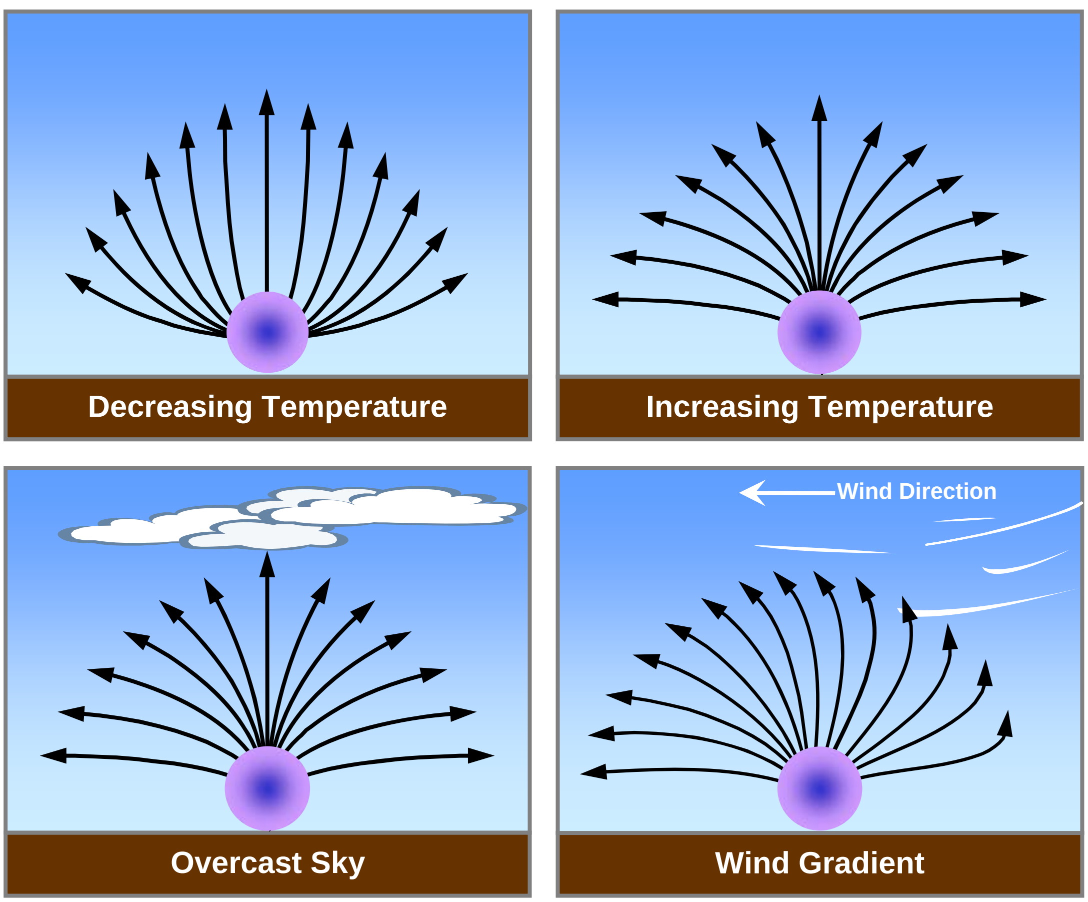
Source: http://www.powerfromthesun.net/chapter1/Chapter1.htm

Solar insolation variance, and hence potential Project operation levels that are indicative of less than the full 177 MW capacity, can also occur due to cloud cover or when ground wind speeds exceed levels considered safe for Reflector operation.

3.2.5.3 Temperature Inversions

Over long distances, and as introduced by subsection 3.1.2.2.7, sound at lower frequencies becomes dominant as the higher frequencies are more rapidly attenuated. This helps explain why animals with the ability to hear lower frequencies, such as dogs, can detect and respond to sound that a human might not readily perceive. Air temperature and humidity affect the rate of this attenuation with increasing distance. Turbulence, cloud cover, gradients of wind and other atmospheric phenomena also play a significant role in determining the degree of attenuation. For example, certain conditions, such as temperature inversions, can channel or focus the sound waves resulting in higher noise levels than would result from simple spherical spreading. Typical effects of such sample phenomena are illustrated in Figure 17, with some explanation as follows.

Figure 17
Sample Atmospheric Effects on Outdoor Sound Propagation



Temperature typically decreases at a rate of 3.5º Fahrenheit per 1,000 feet of altitude under normal atmospheric conditions. This temperature variation with altitude is referred to as the temperature lapse rate. Under certain conditions, this normal vertical temperature gradient is "inverted" when the air is colder near the ground surface. This can occur when, for example, a warmer and less dense air mass moves over a cooler, denser air mass. This type of inversion occurs in the vicinity of warm fronts, and also in areas of oceanic upwelling such as along the California coast. An inversion is also produced whenever radiation from the ground surface is less than the amount of radiation received from the sun, which commonly occurs at night, or during the winter when the angle of the sun is very low in the sky. This effect is virtually confined to land regions as the ocean can retain heat for a longer duration.

An inversion is also called a "stable" air layer, and acts like a lid that keeps normal convective overturning of the atmosphere. With sufficient humidity in the cooler layer, fog is typically present below the inversion cap. Another effect is the trapping of air pollutants below the inversion layer, allowing them to build up in the air mass nearer to the ground. If the sky is very hazy, or if sunsets are very red, there is likely an inversion somewhere in the lower atmosphere. This happens more frequently in high pressure zones, where the gradual sinking of air in the high pressure dome typically causes an inversion to form at the base of a sinking layer of air. Another effect is making clouds spread out and take on a flattened appearance. Still another effect is to prevent thunderstorms from forming: even in an air mass that is hot and humid in the lowest layers, thunderstorms will not occur if an inversion is keeping the hot, humid air from rising.

Although temperature inversions and cloud cover can result in higher noise levels at specific locations, in the case of solar power facilities their effects are mitigated by the expected decreased facility output during these periods. In other words, the hazy, foggy or cloudy skies normally associated with daytime inversions would correspondingly reduce solar insolation and hence the operation level of the facility to generate electricity. So while sound may travel farther during these inversion periods, the lower output of the facility (and correspondingly reduced loads on such Project components as the ACC pair) under these same conditions would be expected to experience lower source sound levels. Thus, the net effect of an inversion on the predicted sound levels shown in Section 3.2.5.1 is expected to be insignificant.

3.2.5.4 Wildlife Effects

Available research on the effects of noise on wildlife, such as the literature review by Larkin (1994), suggests that while noise impacts on wildlife are possible, the effects vary with species and knowledge of those effects can be very limited. However, and as supported by behavioral studies of certain species, wildlife can demonstrate "habituation" or the ability to tolerate or grow accustomed to natural (*e.g.*, wind through tall grasses and trees, flowing rivers, rainfall, ocean waves, etc.) and man-made noise sources that comprise the outdoor ambient sound environment. This would help explain why, as recounted by members of the public during workshops, wildlife is observed in the Project vicinity and despite the presence of humans and their usual noise-producing activities (transportation, agriculture, etc.).

3.2.5.5 Infrasound

Although some types of industrial and alternative energy producing facilities can produce very low frequency sound or "infrasound" (*i.e.*, sound in the spectrum of frequencies below human hearing, typically understood as 20 Hz and lower), the Project involves technologies, equipment, and processes that are not expected to generate it at a significant level—especially in contrast to known generators of infrasound, like large wind turbines. Further, research (CanWEA 2006) indicates that such infrasound diminishes with distance, and asserts there is “no reliable evidence that infrasound below the hearing threshold produce[s] physiological or psychological effect.”

3.2.5.6 Nighttime Operation Noise

The following tables present the set of prediction results from the Cadna/A® based analyses for nighttime operations. The six cases correspond with a “base” background level from Power Block sources as described in subsection 3.2.4.2.2, and five different potential locations of the reflector cleaning crew vehicle (or other activity that would require a vehicle to get personnel to a Project site boundary, such as inspection or maintenance). These locations are coded in the tables as follows:

A. Crew Vehicle near ML1 and SR10
B. Crew Vehicle near Bell
C. Crew Vehicle near Strobridge
D. Crew Vehicle near ML3 and Reyes
E. Crew Vehicle near ML7 and LT01

Note that in Tables 14, and 15, the portable lighting plant (PLP) has been excluded, to show the difference in predicted nighttime operational sound between a conventional diesel-burning pick-up truck used for the maintenance activity and a vehicle with an electric motor.

Table 14
Nighttime Operation Noise, Electric Vehicle for Reflector Cleaning, No PLP

Reciever	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)						Cumulative (dBA)					
			Base	A	B	C	D	E	Base	A	B	C	D	E
ML1	43	27	23	23	23	23	23	23	43	43	43	43	43	43
ML3	32	28	23	23	23	23	23	23	33	32	33	33	33	33
ML7	40	12	11	10	10	10	11	11	40	40	40	40	40	40
SR10	50	36	26	30	26	26	26	26	50	50	50	50	50	50
Strobridge	24	33	26	26	26	26	26	26	28	28	28	28	28	28
Bell Future	25	20	18	19	19	19	18	18	26	26	26	26	26	26
Bell Existing	25	17	16	16	16	16	16	16	26	26	26	26	26	26
Reyes	33	27	27	27	27	27	27	27	34	34	34	34	34	34

Table 15
Nighttime Operation Noise, Conventional Diesel Vehicle for Reflector Cleaning, No PLP

Reciever	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)						Cumulative (dBA)					
			Base	A	B	C	D	E	Base	A	B	C	D	E
ML1	43	27	23	26	24	23	23	23	43	43	43	43	43	43
ML3	32	28	23	23	24	25	24	23	33	33	33	33	33	33
ML7	40	12	11	11	10	11	11	12	40	40	40	40	40	40
SR10	50	36	26	35	27	26	26	26	50	50	50	50	50	50
Strobridge	24	33	26	26	28	28	26	26	28	28	29	30	28	28
Bell Future	25	20	18	20	20	19	19	19	26	26	26	26	26	26
Bell Existing	25	17	16	17	18	17	16	17	26	26	26	26	26	26
Reyes	33	27	27	27	28	29	29	27	34	34	34	34	34	34

Table 16 shows that with the conventionally powered PLP turned “on”, the differences between Tables 14 and 15 are effectively obscured.

Table 16
Nighttime Operation Noise, Conventional Diesel Vehicle for Reflector Cleaning, Conventional PLP

Reciever	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)						Cumulative (dBA)					
			Base	A	B	C	D	E	Base	A	B	C	D	E
ML1	43	27	23	34	29	24	24	27	43	44	43	43	43	43
ML3	32	28	23	25	27	30	29	26	33	33	33	34	34	33
ML7	40	12	11	13	10	12	12	17	40	40	40	40	40	40
SR10	50	36	26	44	31	27	27	30	50	51	50	50	50	50
Strobridge	24	33	26	28	33	35	30	27	28	29	34	35	31	29
Bell Future	25	20	18	24	26	23	20	21	26	28	28	27	26	26
Bell Existing	25	17	16	22	23	21	17	19	26	27	27	26	26	26
Reyes	33	27	27	29	31	35	35	30	34	34	35	37	37	35

For additional perspective, Table 17 depicts the difference between Table 16 and Table 15.

Table 17
Difference in Nighttime Operation Noise, Conv. Diesel Vehicle, Switch to Battery-powered PLP

Reciever	Ambient Leq (dBA)	NOISE-4	Predicted Noise Leq (dBA)						Cumulative (dBA)					
			Base	A	B	C	D	E	Base	A	B	C	D	E
ML1	43	27	--	8	5	2	1	3	--	<1	<1	0	0	<1
ML3	32	28	--	2	3	5	5	3	--	<1	<1	1	1	<1
ML7	40	12	--	2	0	2	1	5	--	0	0	0	0	0
SR10	50	36	--	9	5	2	1	4	--	<1	0	0	0	0
Strobridge	24	33	--	2	6	7	4	1	--	1	5	6	3	<1
Bell Future	25	20	--	5	5	4	1	2	--	2	2	1	<1	<1
Bell Existing	25	17	--	5	5	4	1	2	--	1	1	<1	<1	<1
Reyes	33	27	--	1	3	6	6	2	--	<1	<1	3	3	<1

In summary, substitution of a conventional combustion-engine powered generator (for powering portable lighting to conduct nighttime Reflector cleaning) with either electric batteries or power drawn directly from the maintenance vehicle (electric or combustion-powered) is anticipated to enable nighttime Project operational noise levels that are expected to meet PSA criteria for less than significant impact: either less than 40 dBA cumulative at Strobridge or less than 5 dBA increase over ambient levels at other receivers. Should the crew maintenance vehicle used for this cleaning activity be electrically powered, prediction results indicate that the increase over ambient at Strobridge would also become less than 5 dBA.

SECTION 4 PROPOSED APPLICANT ACTION

4.1 CONSTRUCTION

Prediction results from the refined analysis model, as shown in Section 3.1.4, suggest that no mitigation (Scenario 1) would expose the Strobridge receiver to an unacceptable range of noise levels during the course of the Project. Figure 11 illustrates that the increase over ambient is predicted to be over 10 dBA. Scenarios 2 or 3 are capable of providing a projected increase over ambient no greater than 10 dBA for the latter half of the 35-month Project construction duration. In effect, when compared to Scenario 1, either Scenario 2 or 3 cuts the potentially impactful time period by half. Scenario 4, the combination of both barrier and engine attenuation options, delivers less than 10 dBA projected increase for the entire 35-month period and even permits 5 dBA or less increase for the final months of construction as modeled.

The Applicant proposes to implement, in a manner that reasonably adheres to the Scenario description so that its predicted mitigation effects may be realized, either Scenario 2 or 3 as part of good construction practice and in combination with construction-related conditions of certification appearing in the PSA (*i.e.*, NOISE-1, -2, -3 and -6), which includes a program to respond to legitimate noise complaints. Should legitimate complaints and/or sound measurements conducted during construction activity determine that additional construction noise mitigation is necessary, the Applicant is prepared to implement the other Scenario not initially elected. This would, in effect, result in Scenario 4.

4.2 OPERATION

4.2.1 Daytime

The Applicant intends to fulfill conditions of certification NOISE-2, -5 and -8 (as appropriate) as written in the PSA. With respect to NOISE-4, the Applicant proposes that the results of its revised predictive analysis, using 100% plant capacity as a worst-case as shown in Table ES-1, become the new Project operation noise levels relating to compliance.

4.2.2 Nighttime

The Applicant intends to fulfill conditions of certification NOISE-2, -5 and -8 (as appropriate) as written in the PSA. With respect to NOISE-4, the Applicant proposes that the results of its revised predictive analysis as shown in Table 15, become the new Project nighttime operation noise levels relating to compliance. Unless usage of a conventional combustion-powered generator to power a portable lighting plant can be sufficiently attenuated with conventional noise suppression techniques, the Applicant will employ either battery-powered portable lighting or a method to power such lighting directly from the maintenance vehicle used for nighttime Reflector cleaning activity.

Should the goal of a nighttime increase over ambient of 5 dBA or less be applied at Strobridge, and if usage of a suitable electrically powered Reflector cleaning crew vehicle (*i.e.*, instead of a conventional internal-combustion powered one) is considered feasible, the Applicant proposes low voltage (under 48V), low horsepower (under 10HP) commercially available electric-powered vehicles to support this nighttime maintenance task work on the Project site. With such electric vehicles, proposed nighttime operation noise level goals for NOISE-4 would be consistent with Table 14.

SECTION 5 LIMITATIONS

The opinions and recommendations presented herein are based in part upon field measurements (both by URS and others) and observations of what are believed to be typical and representative conditions of normal motor vehicle and community activity in the vicinity of the proposed Project and URS' understanding of what are to be normal Project operating conditions, consistent with the season and the Project's operating schedule, as presented in this DNMP. Additionally, the analyses presented herein presume that measured ambient levels would remain relatively constant throughout the duration of the Project's construction.

SECTION 6 REFERENCES

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BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION FOR THE *CARRIZO ENERGY SOLAR FARM PROJECT*	**Docket No. 07-AFC-8** **PROOF OF SERVICE** **(Revised 2/5/2009)**

INSTRUCTIONS: All parties shall either (1) send an original signed document plus 12 copies or (2) mail one original signed copy AND e-mail the document to the address for the Docket as shown below, AND (3) all parties shall also send a printed or electronic copy of the document, which includes a proof of service declaration to each of the individuals on the proof of service list shown below:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 08-AFC-8
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
docket@energy.state.ca.us

APPLICANT

Perry H. Fontana, QEP
Vice President-Projects
Ausra, Inc.
2585 East Bayshore Road
Palo Alto, California 94303
perry@ausra.com

APPLICANT CONSULTANT

Angela Leiba, GISP
Senior Project Manager
GIS Manager/Visual Resource Specialist
URS Corporation
1615 Murray Canyon Road, Suite 1000
San Diego, CA 92108
angela_leiba@urscorp.com

Kristen E. Walker, J.D.
URS Corporation
1615 Murray Canyon Road, Suite 1000
San Diego, California 92108
kristen_e_walker@urscorp.com

COUNSEL FOR APPLICANT

Jane E. Luckhardt
DOWNEY BRAND
621 Capitol Mall, 18th Floor
Sacramento, CA 95814
jluckhardt@downeybrand.com

INTERESTED AGENCIES

***E-mail preferred**
California ISO
e-recipient@caiso.com

*indicates change

INTERVENORS

California Unions for Reliable Energy (CURE)
c/o Tanya Gulesserian
Adams Broadwell Joseph & Cardozo
601 Gateway Boulevard, Suite 1000
South San Francisco, CA 94080
tgulesserian@adamsbroadwell.com

John Burch
Traditional Council Lead
Salinan Tribe
8315 Morro Road, #202
Atascadero, California 93422
salinantribe@aol.com

***Environmental Center off**
San Luis Obispo (ECOSLO)
c/o Babak Naficy
P.O. Box 13728
San Luis Obispo, California 93406
babaknaficy@sbcglobal.net

ENERGY COMMISSION

JEFFREY D. BYRON
Commissioner and Associate Member
jbyron@energy.state.ca.us

Gary Fay
Hearing Officer
Gfay@energy.state.ca.us

John Kessler
Project Manager
jkessler@energy.state.ca.us

Caryn Holmes
Staff Counsel
cholmes@energy.state.ca.us

Michael Doughton
Staff Counsel
mdoughto@energy.state.ca.us

Elena Miller
Public Adviser
publicadviser@energy.state.ca.us

DECLARATION OF SERVICE

I, Kristen E. Walker, declare that on February 13, 2009 I deposited copies of the attached CESF Noise Mitigation Plan in the United States mail at (FedEx) with first-class postage thereon fully prepaid and addressed to those identified on the Proof of Service list above.

OR

Transmission via electronic mail was consistent with the requirements of California Code of Regulations, title 20, sections 1209, 1209.5, and 1210. All electronic copies were sent to all those identified on the Proof of Service list above.

I declare under penalty of perjury that the foregoing is true and correct.

*indicates change